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Information Brokers: A Comparison of the Web Browser Choices between Internet Users in the US and China

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Information Brokers: A Comparison of the Web Browser Choices between Internet Users in the US and China

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in Sociology

by

Kevin Shih

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ABSTRACT OF THE DISSERTATION

Information Brokers: A Comparison of the Web Browser Choices between Internet Users in the US and China

by

Kevin Shih

Doctor of Philosophy in Sociology

University of California, Los Angeles, 2020

Professor Rebecca Jean Emigh, Chair

By treating web browsers as information brokers, this dissertation found that the rise of Google Chrome in China and the United States (two countries with vastly different regulations) is contingent on Google and its competitors' cultural reputations (as suggested by previous research). This dissertation also found that Chrome's popularity in the US and China is affected by how it is connected to other market entities and popular web services. By examining how a popularly utilized tool is institutionalized in two different countries, this dissertation articulates a new theoretical framework—by combining the sociology of consumption and social network theory—that is more suited to studying online platforms that broker content for internet users.

The dissertation of Kevin Shih is approved.

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TABLE OF CONTENTS

Acknowledgments ix

Vita x

Chapter 1: Introduction 1

The "Common Sense" Answer 5

A "structuralist" view on social action? 6

Justification of case selection and analytical strategy 14

Chapter summaries 16

Chapter 2: A historical account of the macro-level factors that led to Google Chrome's rise in popularity in the US 18

Introduction 18

The web browser market before Google Chrome was introduced 18

United States v. Microsoft Corporation (Web Browser War) 19

Open-sourcing Netscape: The rise of Mozilla Firefox 23

The introduction of Google Chrome 26

When Google Chrome first became the most popular 28

Conclusion 33

Chapter 3. American internet users and their Google Chrome usage 36

US survey 37

US survey sample 37
US survey results 38
Which factors are most significantly associated with Chrome usage? 47
US interviews 50
US interview sample 51
US interview results: Desktop Chrome users 51
US interview results: Non-Chrome users 60
Conclusion 63
Chapter 4. Chinese internet users and their Google Chrome usage 65
CN survey 65
CN survey sample 66
CN survey results 67
Which factors are most significantly associated with Chrome usage? 74
CN interviews 77
CN interview sample 78
CN interview results: Why Chrome on the desktop? 78
CN interview results: Why not Chrome on the desktop? 85
Conclusion 86
Chapter 5. Conclusion 89
US discussion 90
CN discussion 93
Difference in internet economies, difference in preferences and logic 95
Study limitations 97

Research implications 98

Implications for American web browser makers 98

Implications for Chinese web browser makers 102

Implications for broker technology makers 106

References 109

LIST OF TABLES

Table 1 - Logistic Regression Analysis of Google Chrome usage on Desktop Computers (n = 491) 48

Table 2 - Logistic Regression Analysis of Apple Safari usage on Desktop Computers (n = 491) 62

Table 3 - Logistic Regression Analysis of Google Chrome usage on Desktop Computers in CN (n = 411) 76

LIST OF FIGURES

Figure 1. Web browser usage among US survey respondents (n = 491) 39
Figure 2. How US Chrome users first learned about their web browsers (n = 361) 40
Figure 3. How Chrome users in the US value consumer capture features (n = 491) 41
Figure 4. How Chrome users value producer capture features (n = 491) 41
Figure 5. Do Chrome users recommend the services and products of American tech giants? (n = 491) 43
Figure 6. Do Chrome users trust American tech giants to handle their data (n = 491) 44
Figure 7. Chrome users' opinions on Internet Service Providers (n = 491) 45
Figure 8. Chrome users' opinions on monopolies controlling the internet (n = 491) 45
Figure 9. Percentage of users who read, watch, and/or listen to news about personal technology (n = 491) 47
Figure 10. Web browser usage amongst CN survey sample (n = 411) 68
Figure 11. How CN survey sample first learned about their web browser (n = 181) 69
Figure 12. How Chrome users in China value consumer capture features (n = 411) 70
Figure 13. How Chrome users in China value producer capture features (n = 411) 70
Figure 14. Percentage of Chrome Users in China who would recommend the services and products of tech companies from the US 71
Figure 15. Percentage of Chrome Users in China who would trust tech companies from the US to handle their data (n = 411) 72
Figure 16. Percentage of Chrome users in China who believe internet access should be free (n = 411) 73
Figure 17. The median age of CN survey participants (n = 411) 74
Figure 18. Desktop Search Engine Market Share in China from Jan 2009 – Dec 2017 105

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Chapter 1: Introduction

Although Tim Berners-Lee created the World Wide Web (web) at CERN (European Organization for Nuclear Research) in 1989 because he wanted to establish a more efficient system of information-sharing between scientists and academics in the world (CERN 2018), the web is now a major aspect of the daily lives of billions of people around the world (Stats 2016b). Not only do people use the web to communicate with others, but they also increasingly rely on it to access information and resources to develop a better understanding of the social world around them. However, as more and more people use the web, the amount of information and data that can be accessed has become overwhelming for the normal human being. In 2017, there were about 1.77 billion websites on the internet (Stats 2018). As the number of websites has increased to a corpus that is humanly unmanageable, individuals need to rely on tools to help them efficiently access their desired information on the web.

This dissertation examines how internet users choose the tools they use to access information on the web. Although the internet has been heavily fetishized as an utility that just exists right near our fingertips (sometimes even closer), in which all information is (in a best case scenario) a few clicks away, the process of getting to this desired information is actually facilitated by a wide variety of actors and technologies. First, one cannot actually access the internet if she does not have a device (e.g., computer, mobile device) that has internet capabilities. In addition to the device, she will also need to have an account with an internet service provider so her device has permission to access the network that is owned by the internet service provider. Once the person has a device that can connect to a network, she will also need a

software application installed on her device (usually a web browser) that can actually open content that is posted on the web. Lastly, to make the web more efficiently navigable, the internet user needs to use a search engine to easily find a website based on a user-inputted query or a social media platform, in which the user trusts the recommendation and behaviors of her "friends" to access information. As all of these actors and technologies serve as intermediaries between internet users and the information provided by content producers, I call them information brokers. In this dissertation, I examine how internet users choose the information brokers they rely on to retrieve information on the web.

The actors that control these tools and technologies have tremendous sway over what people can access and how people can access information online. For example, many academic and popular-sourced studies have shown that search engines (e.g., Google) and social media sites (e.g., Facebook and Twitter)–digital platforms and websites that help their users efficiently find information online–are prone to providing censored and/or manipulated information to their users (e.g., Battelle 2006:153–57; DiMaggio et al. 2001:313–14; Goldman 2013; Hargittai 2000; Introna and Nissenbaum 2000; Luckerson 2016, 2016; McCormick 2015; Noble 2013), while also disregarding the privacy of their users (Dance, LaForgia, and Confessore 2018). Although these tools that people use to efficiently find their desired information online have definitely helped make their lives easier, there is no question that their perceptions of the world around them is facilitated by those who control these technologies.

This dissertation will specifically focus on a more fundamental tool that people use to access the internet–the web browser. A web browser is a software application for retrieving, presenting, and navigating information resources on the web. The internet, as most lay people know it, only became understandable when Berners-Lee created the first web browser in 1990

(Berners-Lee and Fischetti 1999:29) as it was an accessible and widely-available gateway to the World Wide Web (which Berners-Lee is also responsible for). Although it is true that more and more people are accessing information online through task- and content-specific applications due to the rising popularity of mobile devices, most people learned to experience the internet with the help of a web browser (Shenron 2009). Furthermore, most people still use a web browser to access work and school-related resources online. In other words, web browsers still play a crucial role in how people access the web, even though they may not be the only tools that people use to connect to the internet today.

Similar to the controversial technologies (e.g., search engines and social media platforms) that people use to efficiently find content on the web, web browsers also have the power to dictate what people see online and how they see it, especially since most web browser markets are usually dominated by a handful of corporations, in which the market leaders have almost monopoly statuses. As Google Chrome became the most popular web browser in the US, content producers have made it a priority to design their web pages to be optimized for Chrome (Warren 2018). Not only has Chrome forced content producers to use specific markup languages to play audio and video on web pages (e.g., Adobe Flash vs. HTML 5) (Bright 2018), Google has also pro-actively implemented ad "filters" that dictate how content producers can make money through their websites (Kastrenakes 2017).[1] In other words, Google, being the dominant player

[1] It is definitely true that some of Google's decisions on how ads should be presented on the web resulted in a more aesthetically pleasing and "efficient" internet. The problem here is that by making Google the most popular web browser in the world, people are essentially giving Google control of what the internet should look like. Some people might be uneasy about having a for-profit corporation be responsible for this.

in the web browser market in the US, has had incredible influence over how online information is presented to its users.

In this dissertation, I explain how Google came to dominate the web browser markets in the US and China. Although Google's search engine and other web services left China in 2010, Google's Chrome browser is at the end of 2017 the most popular web browser on personal computers in China with about 60% market share and none of its competitors having over 15% market share (StatCounter 2018a). The US web browser market is structured in a similar manner with Google Chrome being the most popular web browser in the country (StatCounter 2018b). A major goal for this dissertation is to identify the mechanisms driving the web browser preferences of internet users in two countries with very different internet economies (in the sense that the entities that provide services are drastically different). I will specifically address three different questions: 1) When deciding between web browsers, what are the most important factors that drive internet users' preferences? Are these preferences the same between the US and China? 2) How did Chrome become the most popular web browser in the US? and 3) How did Chrome become the most popular web browser in China, even though almost all of Google's services have been blocked in the country?

By answering these three major questions regarding web browser usage in two of the biggest internet economies in the world, I intend to better understand how the information brokers we have increasingly relied upon to establish our worldviews have occupied their dominant positions. Although it is true that our lives have been bettered with the introduction of these technologies, the companies that directly control these technologies are actively serving as gatekeepers on the internet, especially with the way that these markets are being dominated by

single corporate entities. This dissertation hopes to highlight how information brokers end up occupying these powerful positions that have the potential of shaping people's worldviews.

This chapter is organized in the following manner: First, I describe how the "common sense" answer to my main research question is insufficient. Then, I describe the theoretical framework that I utilized to answer my research question. The theoretical framework is followed by my justification of the case selection. Lastly, I conclude by summarizing the chapters and methodologies employed in this dissertation.

The "Common Sense" Answer

How did Google Chrome become the most popular web browser in the US and China? As web browsers are software applications that people use to open websites on the web, the "common sense" answer is that Google Chrome is just faster and more effective at opening web pages than its competitors. However, this answer is much too simple, especially when considering how the global web browser market was structured before 2001. During the "first browser war" (1995 - 2001), Microsoft's internet explorer was able to overtake Netscape in the market not because it created a superior and faster product, but mainly because its browser was bundled with its widely popular computer operating system, Microsoft Windows (Auletta 2001).

Although the speed and effectiveness of a web browser definitely affects the preferences of internet users, it is unclear how important these factors are, especially since there is precedence showing that speed and effectiveness are secondary concerns to internet users during the "first browser war." Furthermore, there have been several speed-tests indicating that Google Chrome was not always the fastest browser available (e.g., Gordon 2012). To develop a more comprehensive answer to the question as to how Google Chrome became the most popular web

browser in two very different social contexts, I invoke a theoretical approach that is drawn from treating the preference for web browsers as a discrete form of social action that is embedded in a larger social structure. This decision-making is motivated by mechanisms that can be identified when treating web browsers as a broker that mediates an internet user's access to content, and while treating web browsers as a commodity to be consumed. Below, I first describe my general approach to social action before I discuss the various mechanisms that could be observed when treating web browsers as commodities and brokers.

A "structuralist" view on social action?

Social action can be defined as any meaningful behavior that is oriented to the past, present, or future behavior of others (Weber 1978:22). When one chooses to use a web browser or any other information broker, one is undoubtedly performing a social action, in which the choice of an internet user is not only oriented to what man-made content is available online, but this behavior is framed around the information brokers (and those responsible for the information brokers) that are available to internet users.

Although neoclassical economists have often assumed a means-end, rational choice model of social action, in which a social actor always deliberately and rationally chooses a line of action that maximizes her utility based on a pre-existing set of stable preferences, a wide-ranging cohort of social scientists have expanded on this model by relaxing some of these assumptions. Not only is it possible for actors to act in "irrational" ways, in which they can have other motivations outside of deliberate resource maximization (Kahneman 2013; Lizardo et al. 2016; Tversky and Kahneman 1974; Vaisey 2009; Weber 1978:24–25), but the way people act is

often dependent on the task environment at hand (Biernacki 2005:79; Emirbayer and Maynard 2011:228; Gross 2009:366; Heritage 1991:128; Martin 2011:337).

To fully capture how and why people use the web browsers they prefer in the US and China, I believe it is fruitful to conceptualize internet users as individuals in a social structure performing a social action. According to Sewell (1992:19), social structures are sets of mutually sustaining schemas and resources that constrain and enable social action that are also often reproduced by that social action. Schemas, in this conceptualization, are an individual's know-hows, cultural values, habits, and beliefs (Sewell 1992:7–8 & 15). Resources, on the other hand, are actual non-human and human materials that are differentially distributed based on the task environment at hand. Schemas and resources are mutually sustaining because an individual will acquire a different set of schemas based on the different resources she has. At the same time, how an individual will use her resources is contingent on the schemas she has acquired. Both a person's schemas and resources affect how she acts, and her actions in return will refresh and update the schemas and resources that are available to her.

In this dissertation, I am treating web browser choice as an individual social action that is ultimately affected by an individual's schemas and resources available to her. To capture the potential schemas that may affect a person's web browser choice, I draw on the literature of consumption and commodities, in which I treat the web browser as a commodity. To capture the potential resource arrangement that may affect a person's web browser choice, I draw on social network theory, in which I treat the web browser as a broker.

Web browsers as commodities

By treating a web browser as a commodity, one can capture the schemas, cultural meanings and values, that could potentially explain why people use the web browsers they use. Marx (1976:133) defines a commodity by its value, which is made up of two factors: its use value and exchange value. The use value correspond to the quality and utility of the object for the user, whereas the exchange value corresponds to the quantitative amount of embodied labor time required to create the commodity. Although most web browsers today are not bought and sold in the same way as other commodities (e.g., wool coats, bread, beer, and meat), since they are usually software applications that could be acquired for free (although there was a time when Netscape was being sold for money back when the web browser was first introduced), they still have a use value and exchange value. Not only do web browsers provide a utility to internet users, in which they help them access information on the web, but they also have an exchange value, which is constituted by the amount of embodied labor time provided by computer programmers, marketers, distributors, and other people who are responsible for the creation of the individual web browsers.

As commodities are socially constructed entities that are contingent on political, cultural, and social circumstances (Appadurai 2005:3; Zelizer 1989), commodities are generally imbued with cultural signals, meanings, and symbols. As people from different social classes have different habituses, the transposable dispositions of acting that arises out of their material conditions and environmental circumstances, they are known to value the cultural meanings of commodities differently (Bourdieu 1984; Lamont 1992; Peterson and Simkus 1992). For example, manual laborers in French society are shown to consume different commodities than

those in the intellectual and bourgeois class (Bourdieu 1984:203–5). In this dissertation, I directly capture whether people from different social backgrounds within the same markets (i.e., US and China) have different web browser preferences.

Not only do people from different class backgrounds consume commodities differently because they value the cultural meanings differently, but people are also known to consume goods that are presented with meanings, images, and symbols that are appealing to them (Wherry 2012:17). In Veblen's (1899) influential study of the "leisure class," he argues that it isn't just people in the upper classes that are consuming in a manner that publicly displays their wealth, but people who are striving for that social prestige are also inclined to practice conspicuous consumption because that is a cultural connotation that they desire. Brown (2013) also found that people consumed fair-trade goods because they were attracted to the altruistic meanings of these goods. Similarly, Zelizer (1981:1038) found that parents continued to buy life insurance for children due to a change in the cultural valuation of children.

As web browsers can be conceived as a commodity, I explore whether people's web browser choices also correspond to specific cultural values that are appealing and held by users. Specifically, I examine whether people who believe in a free and open web are more inclined to choose a web browser that respects their privacy. Since the internet and the World Wide Web were originally conceived as decentralized mechanisms of information sharing (Berners-Lee and Fischetti 1999:1) that values the privacy of its users (Berners-Lee and Fischetti 1999:146), in which the protocols and all its implementations should be freely available to all (Kelty 2008:103; Tozzi and Zittrain 2017:189), those who believe in these values are more likely to prefer a web browser that is published as a *free and open source software* that values user privacy. According to Tozzi (2017:5), free and open source software is a computer program with a publicly available

and modifiable source code. During the "First Browser War," Netscape released its source code as a way to regain the support of computer geeks and hackers who believed that the internet should be an open source and decentralized mechanism for information sharing (Kelty 2008:101).[2] In this dissertation, I specifically examine whether those who subscribe to this view of the internet are more likely to prefer a web browser that is presented in a manner that echoes those views.

Web browsers as brokers

Not only is social action driven by the schemas that a person subscribes to, but it is also affected by the concrete, non-human resources that are available to them in the task environment. To capture how specific non-human resources may affect an internet user's web browser choice, I will treat the web browsers themselves as non-human technological resources that are differentially arranged within the task environment.

One way to capture how web browsers are differentially arranged, and how this arrangement corresponds to web browser choice is by treating the whole process of going online as a social network that is made up of internet users that are only connected if they exchange information online. Web browsers, in this analogy can be treated as brokers, intermediary links between internet users who seek information and internet users who provide information. According to Stovel (2012; 2011:21326), brokers are social entities that facilitate the trade and/or

[2] There are other additional reasons as to why Netscape released the source code. Netscape hoped that they would be able to update their browser more frequently (as a means to combat the resourceful Microsoft) if they had more people working on it. For a more detailed discussion please see Kelty (2008:101–3)

transmission of resources that are otherwise hard to procure. In other words, they are actors that connect two different clusters that generally have no other efficient means of communicating with each other. On the web, web browsers are mostly necessary intermediaries because they help transmit and decipher information on the internet in a manner that is accessible and comprehensible to internet users.

Although social entities that occupy brokerage positions are able to enjoy certain informational advantages (Burt 2007) and have the power to exploit those who rely on their services (Easley and Kleinberg 2010), their structural positions are inherently fragile and it is hard for brokers to remain brokers for long (Stovel et al. 2011:21327). Brokers, by definition, are effective when they are connecting two parties that have difficulty directly communicating with each other. However, as information asymmetries exist between the connecting parties and their brokers, the connecting parties are more likely to distrust and be wary of the services provided by their brokers. As a broker, web browsers also combat this kind of mistrust. Since it is impossible for internet users to verify whether what they are seeing on the web is how its supposed to be presented—unless they verify their experiences utilizing another web browser—the popularity of a web browser could easily be in flux.

However, the "instability" of a broker's position can also be stabilized by how its connected to other social entities. In this dissertation, I examine two mechanisms that could potentially stabilize a web browser's brokerage position, which consequently make it a popularly utilized non-human resource in the larger social structure: broker capture and availability.

Broker capture

In a situation where Party A and Party B rely on brokers to exchange, brokers that clearly favor one party (for example, party A) should have a more stable position (Stovel et al. 2011:21329). When a broker is captured by Party A, Party A can be certain that everything the broker does will be for her benefit. For Party B, although it is unfortunate that the broker will always favor Party A over her in this situation, Party B would still be inclined to utilize the broker's services because they can confidently predict and be certain how the broker would act when utilizing its services. The vice versa applies as well. Broker capture is most commonly observed in the case of language brokering in linguistic minority communities. Many immigrants rely on their children to serve as language brokers to help them navigate the various institutions in their host country (Orellana, Dorner, and Pulido 2003:508 & 521; Stovel et al. 2011:21330; Tse 1996:486–87). Although these children language brokers experience a level of autonomy that is not always observed in children from non-immigrant households (Tse 1996:493), their position as a broker is stable because they are completely "captured" by their families (Stovel et al. 2011:21330).

Broker capture can work in two different ways in the web browser context. First, the web browser can exhibit characteristics and functionalities that favor the internet user; Second, the web browser can exhibit characteristics and functionalities that favor the content producers.

Broker capture by internet users. Web browsers that clearly favor the internet users are the ones that are most popularly utilized. Since most websites on the internet make money from advertisements, including the most popularly utilized web services (e.g., email), one way a web browser can explicitly favor the consumer, instead of content producers, is by blocking the advertisements that content producers rely on for income. In other words, if broker capture (on

the user side) matters, web browsers that favor the internet user by providing them with ad blocking services are more likely to be popularly utilized by consumers. Furthermore, web browsers that practice user-friendly privacy policies should be more favored. Specifically, web browsers that do not track and collect an internet user's information should be more favored by internet users.

Broker capture by content producers on the web. Web browsers that clearly favor content producers that are responsible for the resources, websites, and services on the web could also be the ones that are most popularly utilized. If a web browser is captured by specific content producers on the web, it would be clear to the users that the web browser is going to favorably push the services or information from the content producer that the browser is affiliated with. Although this is not exactly advantageous to the internet user, internet users may still be interested in using the web browser, especially if the web browser is affiliated with popularly demanded content and resources online. In this scenario, internet users may popularly prefer a specific web browser because they believe it's the most efficient way to access widely utilized content and/or resources. If broker capture by content producers matter in the context of web browser choices, web browsers that are owned by popular online services should be more popularly utilized because internet users believe that the web browser is well-integrated with their favorite web services.

Availability

A web browser that is part of a suite of other popularly utilized applications and services should be preferred because it is readily available to the user. Especially when discussing the case of technological use, people are known to uncritically utilize the technology that is readily available

to them, even though this kind of "rationality" may further reinforce existing social order (Marcuse 2004:143). This sentiment is echoed in (a less pessimistic manner in) social network theory. Small (2013; 2016) has shown that people are more likely to utilize the help and consultation of those who are the most accessible and available to them from his studies on discussion and support networks.

With the case of web browser choices, web browsers that are most readily available to the internet users could be the most popular. One of the most common ways for a web browser to be readily available to users is by coming pre-installed and set as the default gateway to the web on the hardware devices that people buy.

Justification of case selection and analytic strategy

In this dissertation, I examine how Google Chrome became the most popular desktop web browser in the US and China. I chose to compare these two internet economies because I am interested in capturing how the two countries could have a similar market outcome, in which Google Chrome is the dominant leader, even though the corporations that actively manage the internet technologies that people rely on to access the web are drastically different in the two countries. US and China are similar in the sense that they both exhibit some of the highest volumes of web activity and internet users (Stats 2016a) in the world. However, the two internet economies are different in terms of how their content and service providers are regulated. The Chinese have essentially banned most American corporations from participating in their internet, as a means to protect their homegrown counterparts, which are much more willing to subject their services to government surveillance and censoring. Because of this government

involvement, almost all of the major internet services in China are provided by Chinese companies that have limited presences in the US context (as of 2018).

Yet, it is precisely China's stance against American internet companies that makes Google Chrome's dominance in China interesting. Although almost all of Google's web services (e.g., search engine, email, YouTube, maps) are banned in China since the company refused to censor their search results for Chinese users (Drummond 2010), their Chrome browser is still available to download in China, and it became the most popular web browser in the Chinese market in 2014 (StatCounter 2018a). In the US, Google Chrome became the most popular web browser around the same time (StatCounter 2018b). A major goal for this dissertation is to identify how internet users in these two very different internet economies could share similar preferences.

By invoking a similar heuristic (albeit a simpler version) used by Emigh et al. (2016a:31, 2016b:15) in their investigation of how censuses around the world gather information, this dissertation will concretely illustrate how social structures at both the mirco and macro level shape the web browser preferences of internet users in the US and China. Since the economic behaviors of individuals are known to be embedded in higher scales of reality (e.g., Granovetter 1985; Polanyi 2005), I also assume that the schemas and materials observed at the individual micro level (which refers to individuals and their interactions) are dialectically related to systematic organizations of culture and resources at the macro level. The goal for the dissertation is to highlight how the micro and macro level variations in the schemas and resources available to the internet users in the US and China could lead to a similar outcome of the majority preferring to use Google Chrome as their primary web browsers on their computers.

Of course, since market contexts change over time, and it is almost impossible to identify just one single similarity between the two countries, I do not employ Mill's method of similarity (Lieberson 1991; Mill 1950) to compare the two cases. Instead of making a causal argument between the antecedent conditions and the outcome, I use the comparison to evaluate whether the expectations of the literature identified above are evident in the comparison.

Chapter summaries

This dissertation is organized in the following manner. In Chapter 2, I provide a historical account of the web browser market in the United States. Starting with a discussion on how Microsoft was able to acquire majority web browser market share in the United States with its Internet Explorer, I historically trace how Google was able to overtake Microsoft's position in the web browser market by taking advantage of the "anti-Microsoft" cultural climate due to Microsoft's antitrust battles with the Department of Justice, and the structural advantage the company had enjoyed by owning and operating some of the most popular web properties during the time. For this chapter, I sampled all of the American newspaper articles on internet browsers found from the FACTIVA database from 01/01/2007 to 01/01/2017 to develop a historical narrative that captures the rise of Google Chrome in the US web browser market. I also consulted secondary sources (e.g., corporate biographies) to construct my narrative.

In Chapter 3, I illustrate how American internet users justify their web browser choices, with a specific focus on examining why most American internet users prefer to use Google Chrome on their desktop computers. Based on a survey (N = 491) that directly asked internet users to identify how and what they do when they go online, I found that Chrome users are significantly different from non-Chrome users in terms of their demographics, values and beliefs

regarding the internet, and their web browser preferences. Additionally, I found that the strongest predictor for desktop Chrome usage in the US is whether the internet user preferred a web browser that is well-integrated with their favorite web services. Using my findings from 16 semi-structured interviews with undergraduate students at UCLA, I try to explain why these trends were observed in the survey.

In Chapter 4, I illustrate how Chinese internet users justify their web browser choices, with a specific focus on examining why most Chinese internet users prefer to use Google Chrome on their desktops. Using the same (translated to Chinese) survey instrument that was used in Chapter 3 (N = 411), I also found that Chrome users are significantly different from non-Chrome users in terms of their demographics and opinions regarding the internet. Different from the US results, the strongest predictor for desktop Chrome usage in China is whether the internet user had a college education. Using the same interview protocol that was utilized in Chapter 3, in which I interviewed 16 undergraduate students at East China Normal University, I try to explain these trends by discussing how most Chrome users first started using the browser, and how most Chrome users feel about Chinese and American tech companies that facilitate their behaviors online.

Chapter 5 concludes this dissertation by summarizing the findings from the previous chapters and providing possible explanations as to why there is a difference in the way Chinese and American internet users discussed their web browser preferences. Specifically, I discuss how the difference in the US and China's larger internet economies contributed to why internet users in the two countries have different reasons for their similar web browser preferences. Additionally, I discuss the limitations and research implications of this dissertation.

Chapter 2: A historical account of the macro-level factors that led to Google Chrome's rise in popularity in the US

Introduction

In this chapter, I describe how the American web browser market has evolved since the aftermath of *United States v. Microsoft Corporation* in 2001. By utilizing a variety of secondary sources, include a series of corporate biographies, popular-sourced books on the internet industry, and 537 newspaper articles on the web browser industry, I constructed a historical narrative of the American web browser market from 2001 to 2015. This narrative focuses on how Google Chrome became the most popularly used web browser in the US in 2015 by examining the macro cultural environment associated with the firms that are responsible for each browser, in addition to how the web browsers are positioned in the larger material environment.

This chapter is organized in the following manner: First, I describe how Microsoft dominated the American web browser market before the introduction of Google Chrome, with a focus on how Microsoft overtook Netscape's position of the market. I also discuss the unintended consequences of Microsoft's aggressive actions, which included an antitrust case against them and the creation of an open-source rival, Mozilla Firefox. Then, I describe how Google started to develop and release its own Chrome browser and show how several cultural and material factors contributed to its rise in the American marketplace.

The web browser market before Google Chrome was introduced

Before Google entered the web browser market, Microsoft's Internet Explorer (IE) was the most popular web browser in the United States. Although IE entered the market in 1995 with an inferior product (Cassidy 2009:88; McCullough 2018:50) almost a year after Netscape's

Navigator 1.0 was publicly available, it quickly eclipsed Netscape's market share in two years (McCullough 2018:51), and became the most popular web browser in November 1998 (Cassidy 2009:197–98). Netscape never regained the market share it lost to Microsoft, and it ended up being acquired by America Online for $4.2 billion in stock in 1998 (Cassidy 2009:198). Although Microsoft soundly defeated Netscape in the web browser market, Microsoft's aggressive actions in the web browser market actually led to two consequences that would hinder Microsoft's ability to continuously dominate the web browser market, especially when Google entered the market: 1) it led to the Department of Justice accusing the Microsoft Corporation for violating antitrust laws and engaging in anticompetitive practices; and 2) it led Netscape to open-source its source code to its web browser. In this section, I detail how these two events transpired and how they affected the cultural environment surrounding Microsoft and Microsoft's Internet Explorer.

United States v. Microsoft Corporation (Web Browser War)

While Bill Gates and Microsoft were chasing the "information superhighway" during the early 1990s, in which Bill Gates and Microsoft thought interactive televisions were the next wave of computing (McCullough 2018:41), Netscape developed a web browser that was released in 1994 to great fanfare and media hype. Realizing that there is a future in which people would do everything online, and web browsers could serve as that platform facilitating how people accessed the web, Bill Gates and Microsoft started investing heavily and quickly in their own web browser and other web research and development (McCullough 2018:48–49). However, since Microsoft was late in investing in and developing their web products, when they finally

released Internet Explorer to the public in August 1995, it was perceived as an inferior product, especially compared to Netscape Navigator.

Although IE was the inferior product when it was first released, it still took over Netscape's market share through Microsoft's strategic maneuvering. First, Microsoft released its web browser for free, so it had a price advantage to the already in market Netscape (McCullough 2018:50). Second, and more importantly, Microsoft bundled IE with its soon to be released Microsoft Windows 95. Since Microsoft had a monopoly with its Windows operating system, the goal for bundling is so that anybody using a Windows operating system would have IE set as their default browser.

If Microsoft had complete control over how its operating system was being distributed to end users, it would have been an easy task to leverage Windows's monopoly to turn more users onto IE. However, Microsoft, at the time, was primarily a software company and it was only able to ensure that the majority of the computer-using population used Windows as their main operating system by licensing the software to computer manufacturers (e.g., Gateway 2000, Hewlett Packard, and Dell) below the retail price (Auletta 2001). When Windows is licensed in this manner, Microsoft did not exactly have complete and direct control over how their software programs are installed on their computers, unless it is specifically articulated in the licensing agreement with the manufacturer. Usually, computer manufacturers are free to pre-install any software of their liking along with Windows, and they have been known to "customize" the operating system for their users.

When it came to IE though, Microsoft aggressively prohibited computer manufacturers from decoupling the browser from the Windows operating system (Auletta 2001:112). As Netscape was the better browser when IE was introduced, many of the computer manufacturers

wanted to either have Netscape replace IE as the only browser that shipped with Windows (Granneman 2005:14) or give users the option (via a start-up sequence when first starting the computer) to pick their default browser (Auletta 2001:57). However, Microsoft prohibited any of its computer manufacturers from doing anything that will diminish the sole presence of IE in Windows by contractually binding the browser with the operating system. In August 1995, when Compaq replaced IE with Netscape on their computers, Microsoft threatened to end Compaq's Windows 95 license, which would consequently destroy the computer manufacturer's profit margins because they would need to pay retail prices to install Windows 95 on their computers (Granneman 2005:13–14). Essentially, Microsoft leveraged its monopoly in the operating system market to forcefully ensure that IE was exposed to everybody who was using a PC.

As this was the start of the dot-com bubble, in which many people were experiencing an "irrational exuberance" regarding all things pertaining to the internet (Cassidy 2009), a lot of computer users were looking for ways to experience the internet for themselves. The fact that Microsoft made its IE free and readily available for the majority of the computer-using population helped quickly obliterate Netscape Navigator's position in the web browser market since any Windows user would be able to use IE to go online without any real barriers of entry. However, the fact that Microsoft was forcing computer manufacturers to bundle its popular operating system with its browser did not go unchecked. Not only did the Department of Justice bring an antitrust case against Microsoft that went to trial in 1998, but Microsoft was actually found guilty in 2000 by Judge Thomas Penfield Jackson in this antitrust trial (Auletta 2001:XIV). The initial judgment of the case was to split Microsoft into two: one company that is responsible for the popular Windows operating system, and another applications company that would foresee the browser, Microsoft Office, MSN, and all Microsoft's content and internet

properties (Auletta 2001:372). Although this initial judgment was successfully appealed, Microsoft settled with the DOJ in 2001. Microsoft agreed to eliminate the restrictive licensing agreements it used to force manufacturers favor Microsoft products over rival software (Lohr 2001). To ensure that Microsoft would not be partaking in any other anti-competitive practices, a three-member advisory committee of independent experts was responsible for monitoring the company's behavior for five years, in which they would have full access to Microsoft's systems, records, and source code (Lohr 2001).

Even though Microsoft's illegal bundling of IE with its popular Windows allowed the company to acquire majority market share in the US browser market within the span of three years, the fact that the company was found guilty in a federal antitrust case (that was supported by at least 20 state attorney generals) created a negative cultural environment that made it hard for it to sustain its dominance in this space. Not only did the court case feature video and email evidence showing Bill Gates and Microsoft acting like entitled, petulant bullies (Auletta 2001), but the case judgment also made Microsoft vulnerable to other government agencies and regulators (e.g., the European Commission), which subsequently brought their own antitrust cases against Microsoft in the following decade. Furthermore, the court case also made many internet users wary of Microsoft's role in the development of the Web, especially among those who firmly believed that the World Wide Web should be an open-source platform. Although Microsoft was able to successfully convince a majority of internet users to use their Internet Explorer by making the browser the most readily available to PC and Windows users, the fact that Microsoft ran into the law along the way created an opening for future web browsers, including Mozilla Firefox and Google Chrome.

Open-sourcing Netscape: The rise of Mozilla Firefox

Although Netscape had the most popular web browser when Microsoft introduced IE in 1995, the company started losing users rapidly to Microsoft, and reported its first losing quarter in 1997 (Granneman 2005:17). Not only was Microsoft achieving this rapid gain in market share by leveraging its Windows monopoly and making IE free of charge, but being the bigger and richer company, Microsoft was also able to invest more resources in IE's development. To match Microsoft's aggressive pricing of IE, Netscape also decided to make its Communcator browser free in 1998. To combat its resource disadvantage, Netscape released the source code of their browser publicly and invited third-party developers to contribute to the program in January 23, 1998 (Tozzi and Zittrain 2017:225).

The Mozilla Organization was founded to oversee the open-source version of Netscape. Explicitly, Netscape open-sourced its browser because it wanted to crowd-source its future development. By referencing an influential text among the Free and Open Source Software movement, "The Cathedral and the Bazaar" (Raymond 2001), Netscape argued that it could be more efficient in debugging and improving its browser software by running the operation like a "bazaar," where thousands of developers and software users with programming skills can contribute to the software's development over the internet (Tozzi and Zittrain 2017:223–24).

Implicitly, Netscape may have chosen to open-source its Navigator browser's code and make the browser free because it wanted to regain some of the "hacker-cred" it had (Kelty 2008:101) and directly appeal to computer users who were against Microsoft's many attempts of thwarting the free and open source software movement.[3] As the internet was founded by techno-

[3] For a more detailed account on Microsoft's war against free and open source software, see Tozzi (2017:211–39)

elites and hackers (Castells 2003:37), in which they firmly believed in freely sharing the source code of software programs as a means to enhance shared collaboration in the pursuit of scientific/technological innovation and the use of computers (Castells 2003:40–41; Tozzi and Zittrain 2017:37), many early adopters and power users on the internet subscribed at least partially to the ideals of the free and open source software movement. By positioning itself as the "Anti-Microsoft," a corporation who has been actively against the culture that is shared among techno-elites and hackers, Netscape tried to make its software, including its Communicator browser, appealing to those users.

However, the goodwill that Netscape was generating from the open source community did not help it regain any of the market share it lost to IE. Netscape also faced tremendous difficulty coordinating their development efforts between Netscape employees, who were still being paid to work on Navigator and Communicator, and third-party contributors, who were volunteering their labor to the open source project (Kelty 2008:107). Because these efforts were ineffective, Netscape was forced to admit defeat, and it was acquired by AOL near the end of 1998. Although Netscape's Navigator browser continued to be developed by AOL, it was not a priority for the company. AOL acquired Netscape because it had one of the most popular websites at the time (Cassidy 2009:198). Netscape never regained the market share it lost to IE and its development was canceled at the end of 2007.

Although Netscape's Navigator never regained its former glory, its open-source spin-off Mozilla Firefox, was slowly but surely becoming a viable alternative to IE. Even though its development was stalled for several years because Netscape was unable to properly execute a bazaar-model of development, it finally received greater support from the open-source community after Netscape formally pulled all funding support for Mozilla in 2003 (Tozzi and

Zittrain 2017:227). In 2004, the first version of Mozilla Firefox was released to great fanfare (Lohr and Markoff 2004), and it quickly grabbed 5% market share in less than 30 days of its release (Granneman 2005:34).

Beginning from Day 1, Mozilla doubled down on its Netscape roots and positioned itself as the "Anti-Microsoft." Not only is Mozilla organizationally set up as a non-profit organization, but it has always positioned itself as an organization that is creating products that promotes an open Web. All of the software that Mozilla releases are free to download, and a lot of them, including its Firefox browser is completely customizable, and users can install and develop as many plug-ins as they want (Granneman 2005:118).

When released, Mozilla and its allies and users advocated for the abandonment of Internet Explorer for a series of reasons: 1) the development of Internet Explorer had stagnated since 1998 (Granneman 2005:19); 2) Microsoft started discontinuing backwards-compatibility for its newest versions of Internet Explorer, so people could only get the fastest and most secure version of Internet Explorer (IE 7) only if they upgraded to the newest Windows (Granneman 2005:22–23), and 3) Internet Explorer had been plagued by a lot of security issues (Granneman 2005:26–29). In other words, Firefox was presented as the more secure and frequently improved browser that was truly free, especial since the browser was not tethered to any specific operating system.

Although a lot of people were (and are still) fans of Mozilla Firefox, the largest market share the browser acquired was near the end of 2009 and the beginning of 2010, in which it acquired just slightly below 32% of market share (StatCounter 2018b). Despite the fact that Mozilla Firefox was released to the market with superior security features, speed, and performance, it did not seem like internet users during this time period thought too critically

about the web browser they used. As Microsoft Windows was the most popular computer operating system, most people just used the web browser that was most readily available to them, which was the default Internet Explorer. However, the fact that Mozilla Firefox was able to chip away a sizable chunk of Microsoft's market share showed that there was a sizable group of internet users, who not only bought into the cultural schemas attached to the whole Mozilla enterprise, but were also technologically savvy enough to appreciate the features that Firefox had.

The introduction of Google Chrome

As Google was building an empire that was majority funded by the advertisement revenue it was receiving from its popular search engine, it started to worry that Microsoft was going to use the same play it used with Netscape against them. Since Microsoft had the most popular web browser, Internet Explorer (IE), and it had its own search engine (i.e., Microsoft Live Search, which later became Bing), it could leverage the popularity (and monopoly) of its web browser to increase the market share of its search engine. By making Microsoft Live Search the default search engine in IE, it would essentially cut off any reason for IE users to utilize Google's search engine, as long as Microsoft Live Search provided search results that were on par with Google's.

To address this concern, Google adopted a two-prong attack. First, it introduced Google Toolbar on December 11th, 2000, an add-on for IE that allowed users to access Google's search engine directly from their browsers without actually needing to visit Google's homepage. It was a defensive move against Microsoft just in case they bundled its search engine with IE (Levy 2011:204–5). Although the toolbar was mostly ignored when it was first introduced, its download numbers increased when the tool bar included a pop-up ad blocker in 2003 (Levy

2011:205). Second, Google signed several multi-year search deals with Opera Software in 2001 (Norwegian News Digests 2007) and Mozilla in 2004 (Cohen 2007), which ensured Google position as the default search engine that is built into the Opera web browser and Firefox.

Although there has been some desire on Google's part to introduce its own web browser as early as 2001 (Levy 2011:204), it was not until 2006 that there were serious internal talks about developing a Google browser. The discussions first came from the Product Client Group, headed by Sundar Pichai, who was also responsible for integrating Google's search engine in the Firefox browser. The Product Client Group was interested in introducing their own web browser because they were worried that the current generation of web browsers (e.g., Internet Explorer, Mozilla Firefox) were not designed to serve as a platform for running programs on the web. Internet Explorer and Mozilla Firefox were conceived in the late 1990s, when the web only served the primary function of transmitting information. Since Google's business model consisted of selling advertisements based on the data they gathered from its web applications' users, including its popular search engine, they were motivated to introduce a new web browser that worked faster and better with its web applications.

The announcement of the Google web browser, Google Chrome, was leaked on September 1st, 2008, and the web browser was publicly released the day after (Vascellaro 2008b). The announcement consisted of an online comic by Scott McCloud, which claimed that Google Chrome would be the fastest, most secure browser on the market, with a clean aesthetic layout that prioritized the content on the web.[4] Google Chrome was also an open-source

[4] The Google Chrome comic is still available to all to see here: https://www.google.com/googlebooks/chrome/

software, even though it did not have the capacity to add any plug-ins or extensions at the time of release.

Although most people know that Google developed and released its own browser because it essentially needed a way to ensure there is a dedicated channel to its search engine, the way Google framed the introduction of the browser is with a language that advocated for the web to remain a free and open source software, and the company explicitly wanted that the web lived up to its "full potential." According to Pichai, Google introduced Chrome because they were invested in helping the "web evolve" (CMP Media 2008b), and they were interested in helping elevate the web into a system of "interactive applications," in which the browser would be the platform to access these applications (CMP Media 2008b). By introducing a web browser that is designed for interactive applications, Google wishes that it would encourage developers to build richer applications on the web (Vascellaro 2008a). Reading between the lines, by finally releasing its own web browser, Google was moving closer to a vision where everything that people do on the computer is actually done over the web, preferably with something that is made by Google (Levy 2011:200–203). Especially when the browser is presented as an open-source software that can be downloaded for free, Google framed its introduction of Chrome as a move that was appealing to those who believe the web should be a free and open space.

When Google Chrome first became the most popular

Although Google Chrome was downloaded 2 million times within the first week of its release (CMP Media 2008a), the hype surrounding the web browser died down fairly quickly. Not only were there speed tests that indicated that Google Chrome was slower than Firefox and Safari (CMP Media 2008b; StreetInsider 2008), but it was also plagued with security issues. However,

as Google's vision with its browser was essentially to force the other web browser developers to start innovating again (Levy 2011:206), it was not too concerned when Chrome missed the internal goal of achieving 20 million users by the end of their first year (Levy 2011:209), especially since its introduction forced its competitors to focus on their browser speeds (Levy 2011:210) and to adopt more advanced features that were often first introduced by Google (CMP Media 2009). As Google made most of its money through its search engine and web applications, the fact that all of the web browsers on the market were not faster and more technologically advanced meant that more people could quickly access Google's suite of web applications. Thus, even if Google Chrome never became the most popular web browser, it still achieved its goal of forcing all the browsers to be platforms that can efficiently interact with rich web applications on the web, which was ultimately beneficial to Google because they are responsible for some of the most popular web applications during that time (Levy 2011).

Yet, Google Chrome's numbers did grow. Not only did it reach over 120 million users by the end of 2010, but it also took its first lead in the browser market in 2013 (StatCounter 2018b). Although it is true that Chrome did become one of the fastest and most secure web browsers on the market because Google updated the browser at a breakneck pace, the speed and security of the browser was never head and shoulders above its competition, especially when compared to the newest versions of Internet Explorer (Askari 2009; Boehret 2010; Rooney 2011) and Safari (Reinholz 2009). As raw performance may not be a sufficient explanation as to why Chrome became the most widely used browser in the US, I argue that several cultural and material factors also contributed to the rise of Google Chrome during this time period:

First of all, the cultural connotation surrounding Microsoft only deteriorated even further after its antitrust case with the Justice Department. As the media coverage of Microsoft during

the *United States v. Microsoft Corporation* case has portrayed the company as a corporate bully that was aggressively against an open and free web, the coverage of the consequent antitrust cases, especially the complaint brought forward by Opera software (Kiviniemi 2009) to the European Commission (EC), reinforced the notion that Microsoft has been guiltily leveraging its Windows monopoly to gain and maintain market share in the web browser space. In January 2009, the EC argued that Microsoft has "harmed competition between web browsers, undermined product innovation and ultimately reduced consumer choice" by bundling IE to its Windows operating system (Associated Press 2009). Google, Firefox, and other technology companies became "third parties" in the case, in which they willingly provided testimonies and support in the EC's investigation (Helft 2009; Kiviniemi 2009). Microsoft settled the case with the EC, as it agreed to include a ballot screen of browser choices in Windows (White 2009). This move ultimately removed IE from its position as the most readily available browser for Windows users in Europe. Although the EC decision had no direct consequences to internet users in the US (unless they invested in Microsoft), the American media coverage of Microsoft's conflicts with the EC reinforced the notion that the company was guilty of utilizing anticompetitive practices to gain market share on the web.

Another factor that may have plagued Microsoft's standings in the mind of users is the company's inability to force everybody to upgrade to the newest version of its browser, especially businesses and corporate users (Jones 2011). When Microsoft released IE 9 in 2011, most internet users were still using IE 6 for work, which was a ten-year-old browser at the time. The fact that people were being forced to use an old Microsoft browser for most of their waking lives made it unappealing for them to use or try any Microsoft browser during their free time

(Goldman 2011). This is why Google Chrome usually saw its relative usage spike over weekends, especially during the first couple years since Google first introduced Chrome.

Businesses still used IE 6 because many of the internal web applications that they used were written specifically for the browser and they did not work for newer versions of IE or any other browser (Jones 2011). Although many businesses were reluctant to invest money in rewriting these web applications, they needed to abandon IE 6 for security and performance reasons. The fact that businesses need to upgrade their web browsers created an opening for Google. Google introduced Chrome for businesses at the end of 2010 and it was quickly embraced by IT administrators in the country (ecPulse 2011). The fact that many companies made switch to Google Chrome helped expose the browser to more internet users, which contributed to the browser's increasing popularity.

Although Microsoft's diminishing reputation due to its antitrust troubles with government agencies and its inability to entice users to upgrade may have contributed to it losing significant market share in the browser market, Google was significantly gaining market share during this time period through its active altering of the material and cultural environment. Not only was Google forming partnerships with other market entities to make Chrome more easily accessible to a wider audience, but it was also prominently featuring the browser in all of its web applications. Furthermore, Google also initiated a TV media blitz that reinforced Google's commitment to evolving the web. All of Google's actions in the cultural and material environment helped make its browser more enticing to a larger population in the US.

First, Google Chrome's rising popularity corresponded to the company's deliberate efforts of making the browser as accessible as possible. To ensure that almost all of the computer-using population can use Google Chrome, Google released Mac and Linux versions of

its browser at the end of 2009 (Levy 2011:210). At the same time, Google signed several partnership deals with laptop makers, including Sony (Osawa 2009), to ensure that Google Chrome was pre-installed on their laptops, which effectively made Chrome the most readily available browser to their users. The fact that Google Chrome worked on the three most popular computer operating systems, while coming pre-installed as the default browser on certain computers definitely contributed to the browser's popularity.

Google Chrome also made a deliberate effort to ensure that its browser was an efficient gateway to the utilities and applications that people most frequently use on the web. As Google has always had the goal of replacing the computer operating system (i.e., Microsoft) with an internet-centric, cloud computing-oriented work environment, Google invested heavily in creating and acquiring its own web applications. Before Google released Chrome, Google owned some of the most popular applications (and websites) on the web, like Google Search, Gmail (introduced in 2004), and YouTube (acquired in 2006), it also was actively developing less-popular applications, like Google's own web-based productivity suite (e.g., Google Docs, Google Sheets, and Google Slides), and high-concept applications that showcased the computing potential of the web (e.g., Google Earth). Essentially, all of Google's web apps and websites were used to promote the company's Chrome browser. Not only did the company claim that all of these apps worked better (sometimes they can only be accessed) with Chrome, but after IE 6 suffered a security attack, it also explicitly encouraged its web app users to stop using Microsoft's browser (CMP Media 2010).

In addition to using its own suite of web applications and services to promote its web browser, Google also made sure that the browser offered a suite of third-party applications that can be easily accessed by its users. Google included a web app store in its October 21st, 2010

update, which allowed users to freely install extensions, plug-ins, and other customizations that improved a user's web browsing experience. As Google Chrome gained in popularity, third-party developers were starting to design apps that were optimized for Chrome (Warren 2018). For users who needed specific web apps that were optimized for Chrome, Google's deliberate cultivation of a web app marketplace made Chrome a necessary platform to access these apps.

Lastly, Google's rising popularity in the American web browser market also corresponded to a deliberate TV media blitz that reinforced Google's reputation as a company that was "freely" giving its software away so people can enjoy the best possible experience on the free and open web. In 2011, Google launched an ad campaign on television to promote the Chrome browser. Instead of focusing on Chrome's speed and security, especially in comparison to their competition, the ads generally highlighted how people were living their best lives using Google's suite of services, like Gmail, Chrome, and others (Tessler 2011). The ads highlighted how the internet worked better when it was mediated through Google. Aligned with how Google has always presented itself up to this point, the TV ads reinforced Google's reputation of an innovator that was committed to evolving the web as an open and free platform.

Conclusion

In sum, the popularity of web browsers is contingent on how it is situated in the larger cultural and material environment. Before the introduction of Google Chrome, Internet Explorer was able to quickly become the most popular web browser in the US because it was bundled with the most popular computer operating system at the time, Windows. As browsers can be treated as brokers that connect internet users with content on the web, Internet Explorer became the most widely

used broker in this context because it was the most readily available to internet users. The case of IE's rise to popularity in the American context provides support for Small (2017).

However, as Microsoft was partaking in anti-competitive business practices when ensuring that its browser was bundled with its operating system, the legal ramifications created a cultural environment that was unfavorable to Microsoft. Some internet users, especially those who subscribe to the ideals of techno-elites and hackers (Castells 2003:37), were turned off by Microsoft's actions of trying to monopolize the web and were eager to look for alternatives. Mozilla Firefox was able to attract users who subscribe to the ideals of techno-elites and hackers by establishing itself as a non-profit organization and releasing their browser as an open-source program.

Although Google originally decided to work on its own browser because it wanted to ensure that Microsoft would not siphon users away from its search engine, Google Chrome still slowly but surely became the most popular web browser in the US due to its position in the cultural and material environment. By treating Google Chrome as a broker between internet users and content producers responsible for web apps and websites, one can see that Google's popularity (and stability as broker) could be contributed to the fact that it was "captured" by content producers (Stovel, Golub, and Milgrom 2011). By convincing all of those involved that the web apps and websites that people want to visit, including those made by Google and those made by third parties, are most efficiently accessed via Chrome, it made Chrome an attractive browser option for those who frequently accessed these resources. The way Chrome is concretely connected to popular web apps and websites has definitely contributed to its popularity.

By treating Google Chrome as a commodity, one can also see that Google's reputation as an "anti-Microsoft," an entity that is supportive of the Free and Open Source Software

movement helped make the browser attractive to those who believed in a free and open web. In addition to releasing Chrome as an open-source and free software, Google was also able to attract more users through advertisements that highlighted its difference from Microsoft—unlike Microsoft, who was interested in unilaterally controlling the web, Google was interested in ensuring that the web reaches its full potential as a free and open computing platform. The cultural connotation surrounding Google made the browser an attractive option for internet users.

By describing the historical developments of the web browser market in the US after the rise of Microsoft's Internet Explorer, this chapter articulates the larger material and cultural environment that surrounds and informs American internet users' web browser preferences. In the next chapter, I use a series of interviews and surveys to capture how internet users justify their web browser choices in their own words, with the specific aim of capturing how Chrome users and non-Chrome users are different in the US, and what the biggest drivers for desktop Chrome usages are in the American context.

Chapter 3. American internet users and their Google Chrome usage

In the last chapter, I described the macro-level cultural and material environments that inform American internet users' web browser preferences by articulating a historical trajectory of the web browser market in the US, starting from Microsoft's introduction of its Internet Explorer. In this chapter, I describe how American internet users in 2019 justified their web browser choices by reporting results from a series of interviews and surveys, in which I directly inquire about their choices and their general online behavior.

According to my interviews and surveys, I found several major differences between Chrome users and non-Chrome users in the US. Not only do Chrome users and non-Chrome users differ in terms of the features they find important in their web browsers, but demographically speaking, Chrome users tend to be younger, more educated, more female, and more interested in personal technology news than non-Chrome users. Furthermore, they are more inclined to trust and recommend the services of tech giants (i.e., Amazon, Apple, Facebook, Google, and Microsoft), and they tend to feel more positively about their internet service providers.

From my survey data, I also found that the strongest predictor of Chrome usage in the US is whether the internet user wants a web browser that is well-integrated with her favorite web services (i.e., search, email), whereas the factors deterrent to Chrome usage surround the internet user's preferences for a web browser that respects their privacy. The interview results provide some insights as to why this is.

Below, I first describe my survey sample, instruments, and results. Then, I discuss the interviews I conducted in the US to explain the trends that were observed in my survey data.

US survey

I designed, fielded, and analyzed an online survey that captured the internet behaviors of 491 adults in the US. The survey was built and hosted on SurveyGizmo. The goal for the survey was to capture why internet users in the US popularly prefer to use Google Chrome as their web browsers on their computers by asking a series of questions that covered several topics, including:

1. How participants chose their preferred web browser.
2. The most important features of a participant's preferred web browser.
3. A participant's attitudes and beliefs regarding the internet and the largest tech firms that facilitate internet behaviors.
4. A participant's level of proficiency and interest in technology and computer programming.
5. Demographic characteristics of the participants, including age, race, gender, and level of education.

US survey sample

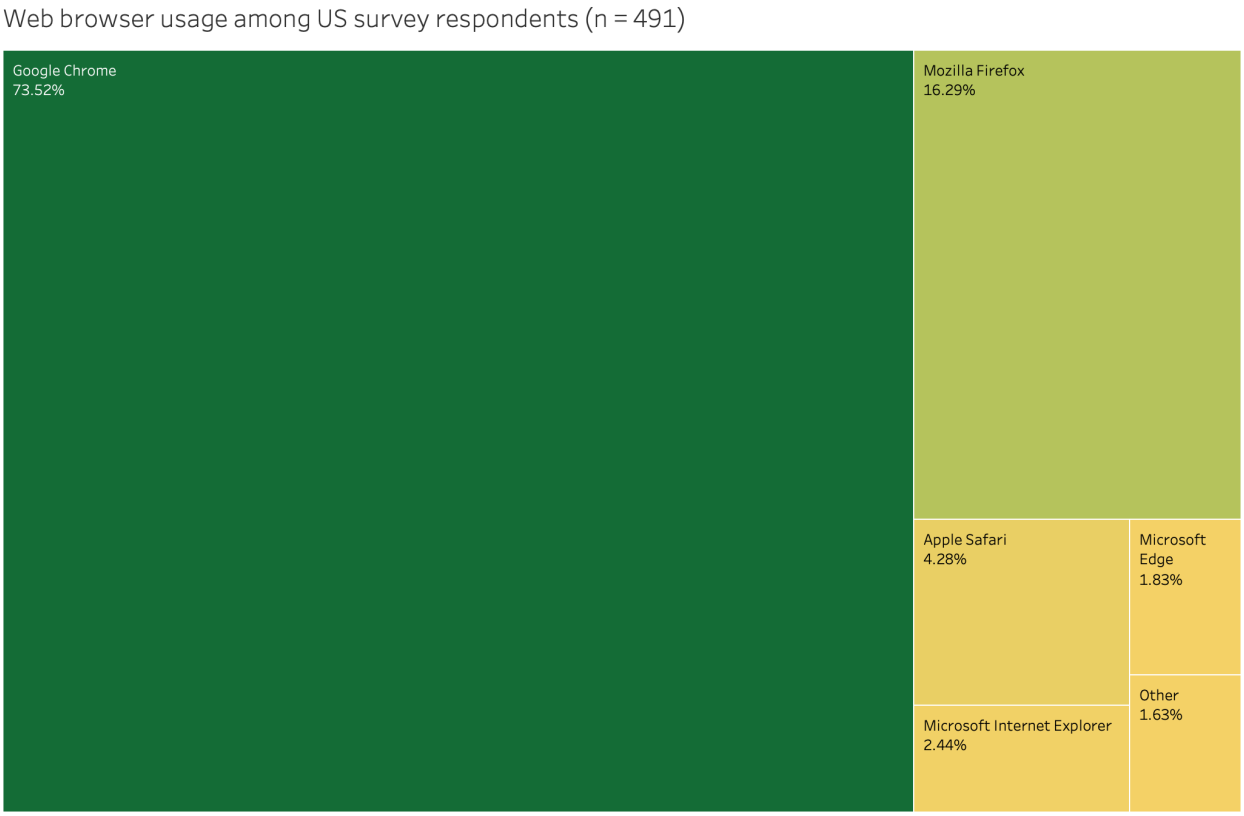
I recruited 491 survey participants through Amazon's Mechanical Turk (MTurk) service in February 2019, which is an online labor market for enlisting and compensating workers for human intelligence tasks (e.g., responding to questionnaires, coding, and transcribing). This represented a convenience sample recruited via job posting in which participants received a $1 reward for completing the survey. To ensure that participants were actively reading the items and response options, I included several attention-check items.

Although online crowdsourcing platforms, like MTurk, are popularly utilized in the social sciences (Berinsky, Huber, and Lenz 2012; Buhrmester, Kwang, and Gosling 2011), the populations who participate in these platforms are not nationally representative. However, the biases in these populations should work in the favor of my research design since I am specifically interested in the preferences of those who are familiar and comfortable with using the internet. Furthermore, the samples generated through these crowdsourcing platforms are more diverse than most experimental convenience samples (Berinsky et al. 2012; Buhrmester et al. 2011).

Of the 491 participants, 42.9% (n = 211) identified as female, 70.7% (n = 347) had at least a college degree, and the median age was 35 (mean = 38.50, SD = 12.49, range: 18 to 82 years).

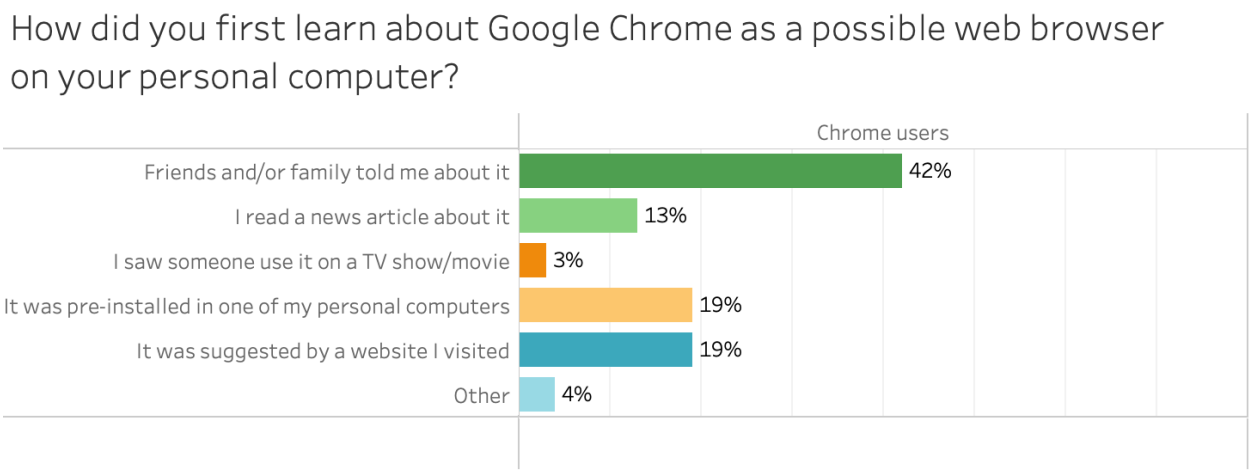
US survey results

Among the American survey respondents, there is no question that Google Chrome is the most popular desktop browser. As shown in Figure 1, 73.52% of survey participants preferred to use Google Chrome on their computers, 16.29% preferred using Mozilla Firefox, 4.28% preferred to use Apple Safari, 2.44% preferred to use Internet Explorer, and 1.83% preferred to use Microsoft Edge.



[Figure 1. Web browser usage among US survey respondents (n = 491)]

Among those who preferred to use Chrome on their desktops, most of them first learned about the browser from their friends and/or family (42%). However, many Chrome users also learned about the browser because it was pre-installed on one of their computers (19%) and it was suggested by a website that they visited (19%).

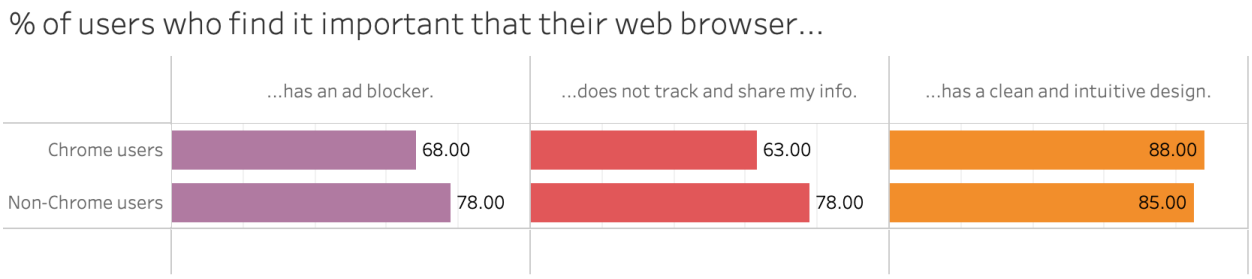


[Figure 2. How US Chrome users first learned about their web browsers (n = 361)]

From the survey results, one could see that there are significant differences in terms of preferences for web browser features, beliefs and attitudes towards tech companies and the internet, and demographics between those who use Chrome on their computers and those who do not use Chrome on their computers. I detail these findings below:

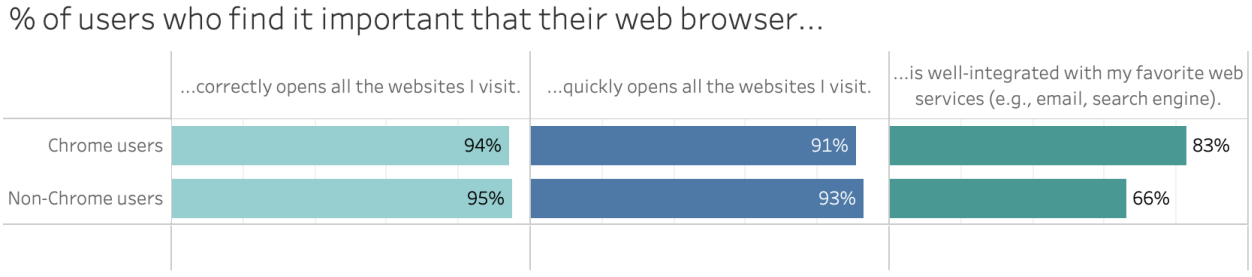
Web browser feature preferences

From the survey results, I found that there was a larger proportion of Chrome users who thought it was unimportant that their web browsers had features that protect their privacy. I also found that there was a larger proportion of Chrome users who thought it important that their web browsers were well-integrated with their favorite web services.



[Figure 3. How Chrome users in the US value consumer capture features (n = 491)]

As shown in Figure 3, there was a smaller proportion of Chrome users who found it important that their browsers had features that protect the privacy of their users. Verified with a two-proportions z-test, the proportion of Chrome users (68%) who found it important that their browser had an ad blocker, was significantly less than the proportion of non-Chrome users (78%) who found ad blockers important. Similarly, the proportion of Chrome users (63%) who found it important that their browsers did not track and share their information, was also significantly less than the proportion of non-chrome users (78%) who found this level of privacy important. On the other hand, there was no significant difference between the proportion of Chrome users who found it important that their browser had a clean and intuitive design, and the proportion of non-Chrome users who felt the same way.



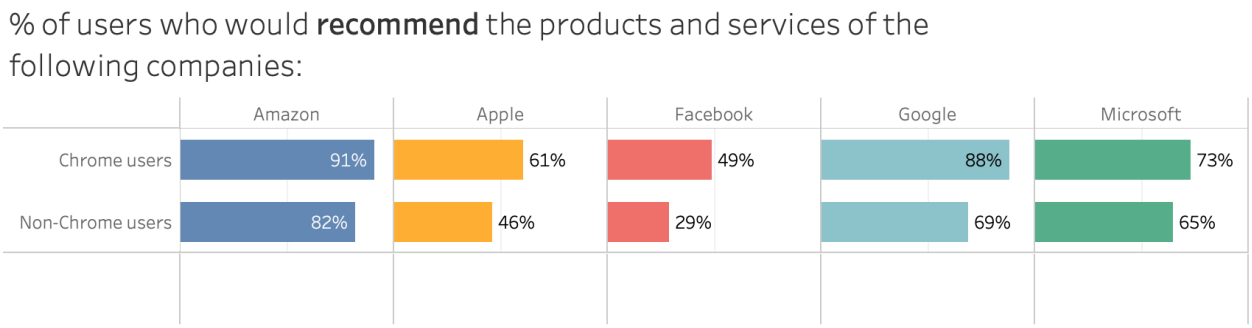
[Figure 4. How Chrome users value producer capture features (n = 491)]

Although there was a larger proportion of Chrome users who found it unimportant that their browsers blocked ads and respected their privacy, there was a much larger proportion of Chrome users who found it important that their browser was well-integrated with their favorite web services. According to Figure 4 and verified by a two-proportions z-test, the proportion of Chrome users (83%) who found it important that their web browsers were well-integrated with their favorite web services, like emails and search engines, was significantly greater than the proportion of non-Chrome users (66%) who found this kind of integration important. On the other hand, there was no significant difference between the proportion of Chrome users and proportion of non-Chrome users who found it important that their browsers could quickly and correctly open the webpages they visit.

In sum, Chrome users were different from non-Chrome users in their preferences for web browser features. Chrome users were more inclined to value features that would allow them to more efficiently access their desired online web services, while also being more inclined to devalue features that protect their privacy. In other words, Chrome users actually found it valuable that Google Chrome was a broker that was captured by content producers, especially those who provided their favorite services and content on the web.

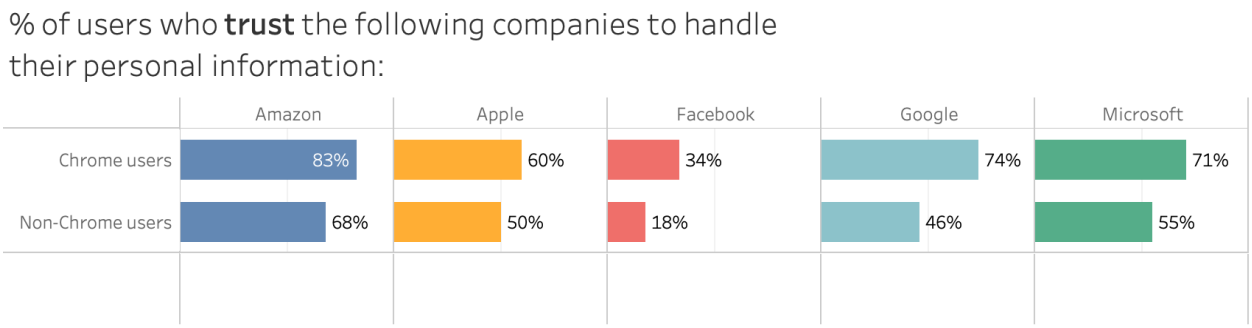
Beliefs and attitudes towards tech giants and the internet

In addition to being different in terms of how they value certain web browser features, Chrome users were also more inclined to express positive attitudes towards tech giants and internet service providers than non-Chrome users.



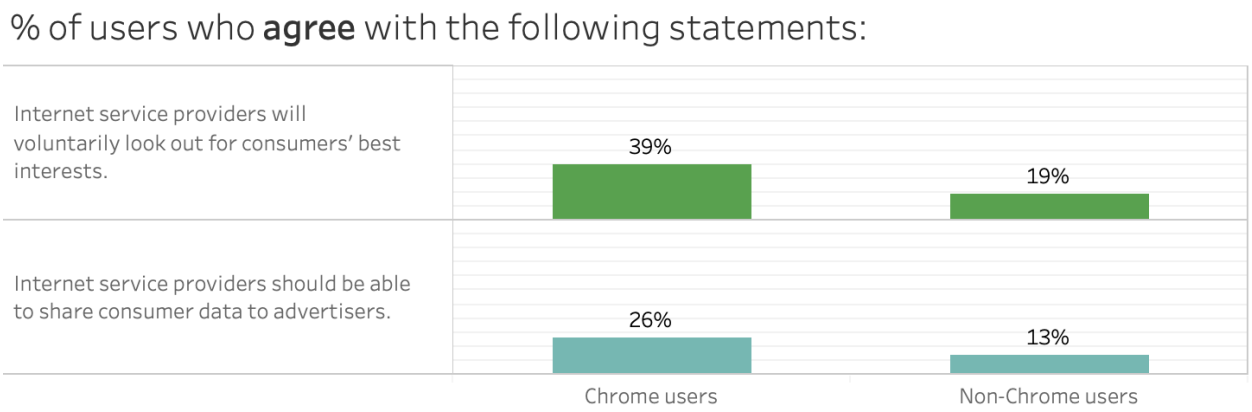
[Figure 5. Do Chrome users recommend the services and products of American tech giants? (n = 491)]

Even though it makes sense for a larger proportion of Chrome users (88%) to recommend the products and services of Google than non-Chrome users (69%) since Google is responsible for making Chrome, a much larger proportion of Chrome users also recommended the products and services of the other American tech giants in the US (see also Figure 5). Not only was there a larger proportion of Chrome users than non-Chrome users that recommends the products and services of popular American tech giants, like Amazon (91% of Chrome users vs. 82% of non-Chrome users), Apple (61% of Chrome users vs. 36% of non-Chrome users), and Microsoft (73% of Chrome users vs. 65% of non-Chrome users), this difference was also observed for the unpopular (at the time) Facebook (49% of Chrome users vs. 29% of non-Chrome users). Similarly, there was a larger proportion of Chrome users who trust Amazon, Apple, Facebook, Google, and Microsoft to handle their personal information, as shown in Figure 6. All in all, there was a larger proportion of Chrome users that would recommend the products and services of the five largest tech companies in the US and trust them to handle their personal information.



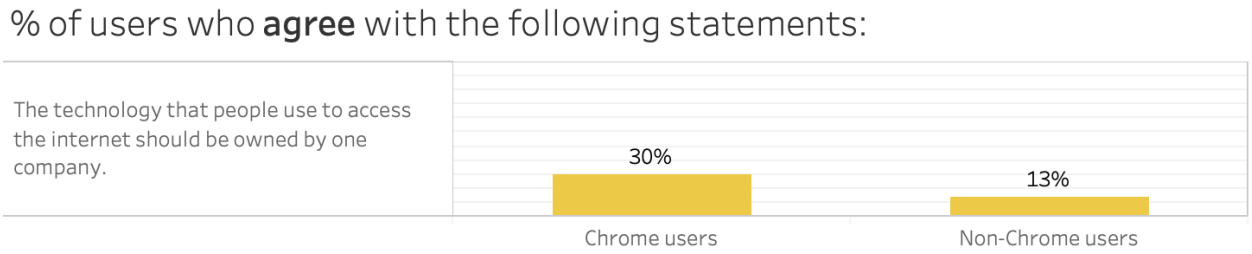
[Figure 6. Do Chrome users trust American tech giants to handle their data (n = 491)]

In addition to feeling more favorably about the five largest tech companies in the US that provides the most popular services online, Chrome users were also more inclined to have positive opinions about internet service providers. Although these proportions were nowhere near the majority (see also Figure 7), there was a significantly larger proportion of Chrome users who felt positively about internet service providers (ISPs). Thirty-nine percent of Chrome users agreed that ISPs will voluntarily look out for their consumers' best interests, whereas 26% agreed that ISPs should be able to share their data to advertisers. On the other hand, only 19% of non-Chrome users thought that ISPs will voluntarily look out for their consumers' best interests, and only 13% of non-Chrome users agreed that ISPs should be able to share their data to advertisers.



[Figure 7. Chrome users' opinions on Internet Service Providers (n = 491)]

Lastly, a larger proportion of Chrome users were also more comfortable with a single company controlling the technologies they use to go online. As shown in Figure 8, 30% of Chrome users in the sample agreed that the technology that people use to access the internet should be owned by one company. Even though this was nowhere near the majority of Chrome users, this number was larger than the 13% of non-Chrome users that agreed with the statement.



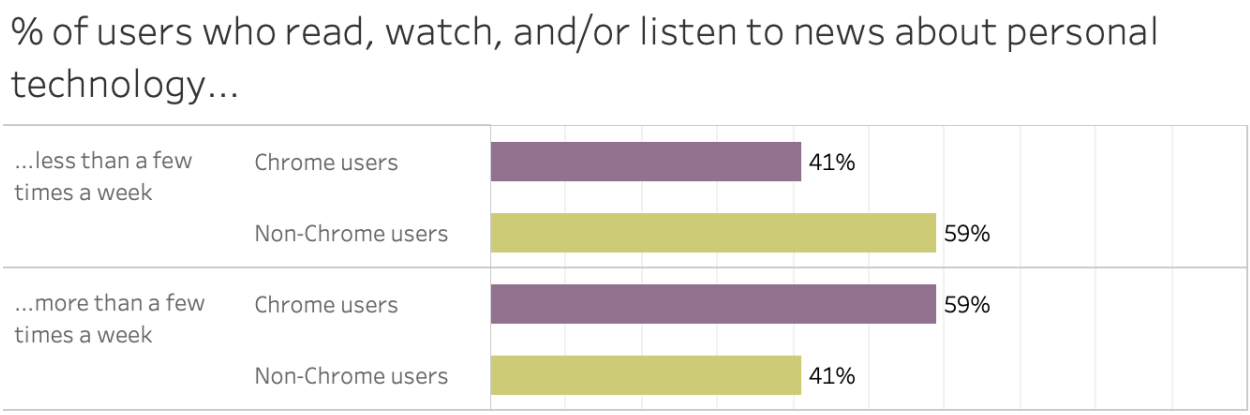
[Figure 8. Chrome users' opinions on monopolies controlling the internet (n = 491)]

In sum, Chrome users and non-Chrome users differed in their values and beliefs in regard to internet service providers and the largest tech companies that provide the majority of services and content on the web. Not only was there a larger proportion of Chrome users who would

recommend and trust Amazon, Apple, Facebook, Google and Microsoft, but there was also a larger proportion of Chrome users who trusted ISPs with their data. Lastly, there is a larger proportion of Chrome users who agree that the technology that they use to access the internet should be owned by one company. In other words, Chrome users were different from non-Chrome users in the sense that they had more positive and optimistic views about the companies that regulate their internet access.

Demographics

Lastly, Chrome users also tend to be younger, more educated, and more female than non-Chrome users. According to an unpaired two-samples Wilcoxon test, the median age for Chrome users (33 years) in the sample was significantly smaller than the median age of non-Chrome users (39 years). Based on a two-proportions z-test, the proportion of participants who identified as female among Chrome users (45%), was larger than the proportion of females who did not use Chrome (36%). Furthermore, the proportion of college-educated users among Chrome users (73%) was also significantly higher than the proportion of college-educated users among non-Chrome users (65%).



[Figure 9. Percentage of users who read, watch, and/or listen to news about personal technology (n = 491)]

In addition to being younger, more educated, and more female, there was also a larger proportion of Chrome users that consume tech news at least a few times a week. As shown in Figure 9 and verified using a two-proportions z-test, the proportion of Chrome users (59%) who consume news about personal technology at least a few times a week, was significantly larger than the proportion of non-Chrome users (41%) who did the same.

Which factors are most significantly associated with Chrome usage?

To capture which of the factors above is significantly associated with Chrome usage on the desktop computer, I constructed a logistic regression model, in which the outcome measure is a binary variable indicating whether someone uses Google Chrome on their computer. The predictors in the model are constructed using the findings above, which consist of variables that capture 1) the demographics of an internet user; 2) an internet user's opinions on browser

features; and 3) an internet user's opinions on tech companies and the internet. The results for this model are shown in Table 1.

Table 1 - Logistic Regression Analysis of Google Chrome usage on Desktop Computers (n = 491)

	b	Std. Error	Z Value	Pr(>|z|)		Odds Ratios
Age (years)	-0.036	0.009	-3.955	7.65E-05	***	0.964
Gender						
Female (v. non-female)	0.597	0.248	2.404	0.016237	*	1.817
Education						
College (v. no-college)	0.387	0.247	1.571	0.116259		1.473
Tech news consumption						
At least a few times a week (v. less than)	0.770	0.241	3.195	0.001398	**	2.159
Opinions on browser features						
Important to have an Ad-blocker (v. not)	-0.588	0.272	-2.16	0.030799	*	0.555
Important to not track and share personal info (v. not)	-0.981	0.271	-3.625	0.000288	***	0.375
Important to be well-integrated with favorite web services (v. not)	1.171	0.273	4.298	1.72E-05	***	3.226
Important to come pre-installed in computer (v. not)	-0.699	0.317	-2.204	0.027554	*	0.497
Opinions on tech companies and internet						
Trusts US tech to handle personal info (v. would not)	0.422	0.381	1.109	0.267401		1.525
Believes that ISPs will look out for their best interests (v. does not believe)	0.790	0.320	2.47	0.013501	*	2.203
Agrees that ISPs should be able to share their data (v. does not agree)	0.068	0.395	0.173	0.862737		1.071
Agrees that internet tech should be owned by one company (v. does not agree)	0.704	0.384	1.835	0.066455	†	2.022
Agrees that consumers should be able to freely access any content they want on the internet (v. does not agree)	0.028	0.339	0.082	0.934969		1.028
Constant	1.532	0.590	2.597	0.009405	**	
Model chi-square =	95.973	p < 0.05				

† p<.10 * p <.05 ** p < .01 *** p < .001 (two-tailed tests) ; standard errors are presented in parentheses.

Note: The dependent variable in this analysis is coded so 0 = does not use Chrome on personal computer and 1 = use Chrome on personal computer.

According to Table 1, Chrome usage is significantly associated with a user's age, gender, and tech news consumption. A one-year increase in an internet user's age changes the odds of using Chrome on the computer by a factor of 0.964. Identifying as female, vs. not identifying as female, increases the odds of using Chrome by a factor of 1.817. Additionally, consuming

personal tech news at least a few times a week, vs. consuming personal tech news less than a few times a week, increases the odds of using Chrome by a factor of 2.159.

An internet user's opinions on browser features are also significantly associated with Chrome usage. Finding it important that a web browser is well-integrated with their favorite web services, vs. not finding this feature important, changes the odds of using Chrome by a factor of 3.226. Finding it important that their browser does not track and share their personal information, vs. not finding this feature important, decreases the odds of Chrome usage by a factor of 0.375. Relatedly, finding it important that your browser has an ad-blocker, vs. not finding this feature important, decreases the odds of Chrome usage by a factor of 0.555. Moving from not finding it important that your web browser is pre-installed on your personal computer to finding this feature important also decreases the odds of Chrome usage by a factor of 0.497.

Lastly, an internet user's opinions on ISPs is significantly associated with Chrome usage as well. Believing that ISPs will look out for their best interest, vs. not believing in ISPs, increases the odds of Chrome usage on the computer by a factor of 2.203.

As most of the predictors in the logistic regression model are in the same units of analysis (i.e., binary factors), we are able to identify the strongest predictor for desktop Chrome usage by comparing the odds ratios of the predictors. According to the model, the strongest predictor for desktop Chrome usage is whether the internet user thinks it's important that their web browsers are well integrated with their favorite web services (e.g., emails, search). On the other hand, the strongest deterrent to Chrome usage is whether the internet user finds it important that their web browser tracks and shares their personal information. Those who find it important that their web browser does not track and share their personal information are less likely to use Google Chrome on their desktops.

In the next section, I discuss the interview protocol, sample, and results to highlight how people's web browser preferences are different depending on the device that they are using (i.e., mobile phone vs. desktop). Importantly, I use the interview findings to explain why web browser features, like finding it important that a web browser is well-integrated with a user's favorite web services, are the most important drivers to desktop Chrome usage in the US.

US interviews

To explore the web browser preferences of American internet users, I conducted 16 semi-structured interviews in Los Angeles. I utilized a convenience and snowball sample to recruit college students from UCLA, in which interview respondents were recruited via in-class announcements in sociology classrooms during in the Summer of 2018. Additionally, interview respondents were recruited via a work-study job board during the same time period.

In these interviews, I asked a series of open-ended questions, in which I explored students' hardware and software choices and preferences for internet access, while also exploring how they interact with these products. Specifically, I asked participants a series of questions regarding their web browser usage. Not only did I ask questions pertaining to how they used their web browsers, I also asked them to recall their thought process when they first used their web browser of choice. Lastly, I asked a couple questions capturing their views and attitudes towards the various web browsers that were currently available on the market. The goal for these interviews is to identify why most of my interview participants popularly prefer to use Google Chrome on their desktop computers.

The interview transcripts were transcribed before they were analyzed using ATLAS.ti.

US interview sample

Among the 16 survey participants, 11 identified as female and 5 identified as male. Not only did I recruit a wide range of students in terms of age (some were about to graduate college, while others were incoming first years), but they also majored in a variety of disciplines, ranging from the hard sciences (e.g., Engineering, Psychobiology, and Environmental Sciences) to the soft (e.g., Business Economics, Political Science, and Sociology). Most of my participants identified as Asian and Caucasian, whereas some identified as Hispanic.

US interview results: Desktop Chrome users

Seventy-five percent of the interview participants had an iPhone, while 75% of the participants also had a personal computer that runs MacOS. Most importantly, 63% of the interview participants preferred to use Google Chrome on their desktop computers, whereas only 38% of the interview participants used Apple Safari. None of the other web browsers (e.g., Microsoft Internet Explorer, Microsoft Edge, and Mozilla Firefox) were used by my interview participants on their personal computers.

Even though most of the interview participants used iPhones and MacBooks, there were largely three different types of desktop Chrome users (based on variations in their hardware and software preferences): 1) Those who used Safari on their iPhones and Google Chrome on their MacBooks (n = 4); 2) Those who used Safari on their iPhones and Google Chrome on their Windows computers (n = 2); and 3) Those who used Google Chrome on their Android phones and Google Chrome on their MacBooks (n = 3). Although these three groups had different preferences in terms of their hardware and web browser on their phones, the way they justified

their web browser preferences, both on their phones and personal computers, was similar. In this section, I first describe how desktop Chrome users justify their mobile web browser preferences. Then, I describe how they justified their Chrome usage on their desktops. Lastly, I discuss how Chrome users started using Google Chrome as their browser of choice on their desktops.

Chrome users' justifications of mobile web browser preferences

For those who said that they used Chrome on their desktops, it was quite common to hear that they used their phones for mostly recreational purposes. In addition to using the phone to text and message their friends and family, everybody in the sample said that they mostly used their phones to check social media (e.g., Facebook, Twitter, Snapchat). Additionally, some also used their phones for streaming (e.g., Spotify, YouTube, Netflix), especially when they are on-the-go.

As the phone was mostly used for recreational purposes for desktop Chrome users, and that many of the activities, like texting, social media, and streaming all have their own dedicated apps, it was evident through the interviews that people did not exactly problematize their mobile web browser choices. In other words, interview participants were most likely to use a web browser that came pre-installed on their phones. One of the most common activities that people used their mobile browsers for was to quickly look up answers to questions they had during their day-to-day lives. For example, Bob (UCLA_5) stated that:

Most of the time I have a lot of questions. It can be anything like what's the conversion from a pound to a kilogram, things like that. Whenever I have questions like that or historical questions or just any questions in general I always open Safari…

In other words, Bob treated her phone's web browser as a software extension of the online search engine that she used whenever she had very simple, mundane questions, like how to convert different measuring units. Other respondents have used their mobile browsers for other inconsequential questions, like finding out the height of Bruno Mars.

Many of the desktop Chrome users I interviewed used Apple Safari on their iPhones, and they all started to use it because it was pre-installed on their phones. Many of these users never used Apple Safari before they acquired their phones. For example, Sam (UCLA_4) started using Safari ever since she got an iPhone. Sam used to use an Android phone and used Google Chrome on that phone, but never decided to install Chrome on the iPhone because:

> …I realized that it just basically does the same thing when you open Safari, so I just find it more convenient… I would say, for my uses, [Chrome and Safari are] comparable because all I do is look up things that aren't very complex. I would say a drawback of using Safari compared to Google Chrome is that you can't as easily access your Google apps.

Since Sam's needs for her mobile web browser were simple, and the pre-installed web browser on her phone (Safari) satisfied her needs, she didn't feel the need to install another web browser on her phone. It was more convenient for her to just use what was readily available on her phone.

Sam's reasonings were echoed by Bob (UCLA_5) as well. Especially since the design of web browsers on the phone are currently reaching a level of isomorphism, in which all browsers have similar designs and performances, she was fine just using Safari on her phone even though she had been an active Google Chrome user on her other devices:

Whenever I have questions like that or historical questions or just any questions in general I always open Safari… because with my iPhone I open Safari and it doesn't feel like Safari. It doesn't feel like any specific web browser. I go to the top search bar and I type in what I need to type in and I'm done."

As Bob discussed how she used Safari, she described a process that implicitly highlighted the importance of convenience with her web browser. All she wanted from a web browser was a search bar, which would give her an answer to a question she types in. As long as the most readily available web browser did that, she was perfectly happy with it.

In sum, since most desktop Chrome users were using their mobile web browsers to answer quick and easy questions that arise in their day-to-day lives, they were more likely to prefer the most readily available browser on their phones. For iPhone users, Apple Safari was the default browser that came pre-installed in their phones. For Android users, Google Chrome was the default browser. These interview findings provide support for Marcuse (1941) and Small (2013), mobile browsers that were most readily available to users were the ones that were most popularly utilized.

Web browsers on computers – Why Google Chrome on the desktop?

As identified in the survey results, internet users in the US were more inclined to use Google Chrome on their desktops if they found it important that their web browser was well-integrated with their favorite web services (e.g., search engine, email). From my interview results, I found that this may be due to the fact that internet users usually used their computers and desktop browsers for tasks that pertained to their school and professional lives. For those who used many

of Google's web services and software to complete these tasks, they were more inclined to use Chrome because they believed it was the most efficient way to access these services.

Although the time that people spend on their personal computers varies from person to person, most people agreed that they usually only go on their personal computers if there was a professional- and/or school-related task that needed to be accomplished. The fact that their personal computers were reserved for more serious and complicated tasks meant that people were spending more time thinking about the software applications installed on their computers, including their web browsers.

Despite the fact that the interviewees who preferred to use Google Chrome had different reasons and preferences for their hardware, the main logic that they used to justify their preference for Google Chrome was similar: since many of these students relied on Google's productivity suite as their means of accomplishing school-related tasks, they wanted to use a web browser that worked best with these web applications. They believed that Google Chrome was the best way to access Google's ecosystem of services. For example, when asked how she first started using Google Chrome on her laptop, Sandy (UCLA_11) described her experience when she got her first MacBook:

"I remember when I first got my first MacBook…I had used Safari for a while because it came with it…Then I kind of made a semi-uncomfortable switch that eventually became comfortable to Google Chrome. I think mainly because of app compatibility… A lot of times, if you want to add other apps to things, like Adblocker or something like that, or the thing that gives you coupons or whatever, those things are more likely compatible with Google Chrome. It seems like apps are always coordinated with Google Chrome which is why I generally made that switch."

Sandy made the switch to Google Chrome because the web browser was more compatible with useful online services that she used. Not only was she attracted to all the extensions (e.g., adblocker and coupon clipper) that could be added to the Chrome browser, but she also believed that online applications, in general, "always coordinated" with Google Chrome.

Similarly, Sam (UCLA_4) also preferred Google Chrome on her computer because it worked better with the web services that she frequently used, especially Google's suite of productivity apps:

If I am on a computer and I am going to be doing work, and so I want to be able to access the links that link me to my work apps like Google Drive and all that stuff, exactly.

The reason why Sam preferred to use Google Chrome on her computer was because she used her computer's web browsers for work and school, and the web browser worked better with the applications that she needed to use in her professional life, specifically applications like Google's file sharing service, Google Drive, and the productivity applications built-in to Google Drive (e.g., Google Docs), which were conducive to peer collaboration.

Similar to Sam, Andy (UCLA_16) also preferred Google Chrome because it provided an easy way for him to engage with Google's suite of productivity apps:

"Personally, I like how Google Chrome has the Gmail option right away because I tend to check my email a lot. It really provides ease and more features like that. It has a little pop-down button so you can just see a bunch of apps. I like that."

As Andy spends a lot of his time on his computer checking his email, he found it valuable that Chrome had a "pop-down" button that let him see all the Google apps, including Gmail, that he used.

"Well, I like how Google Chrome opens immediately on Google, and you can also access your account even from just opening a new tab. Anything that's Google related just because I'm very into with Google, I guess."

This importance of having a browser that works well with Google's ecosystem of apps is echoed when I asked my participants to articulate whether it was possible for another web browser maker to convince them to ditch Google Chrome on their computers. Almost all of the Chrome users found it hard for them to quit Google Chrome because of their reliance on Google's popular web apps. For example, Bob said a new web browser would only be attractive to him if it…

"…[made] tools like Google Docs, Google Drive, Google Sheets, and Google overall better. Because I think we're all creatures of habit in some way, so it's going to be very difficult for me to ditch Google, something I've been using for almost 10 years now for a new browser."

According to Bob, the only way for him to quit Google Chrome is if there was a better ecosystem of productivity apps on the market, and the most efficient way to access these apps is a browser that was not Google Chrome.

Similarly, Sandy (UCLA_11) also found it hard to imagine a scenario where she ditches Google Chrome:

"[a new browser for me to try would need to do] So much. It would have to have so much for me to make that change. I'm so comfortable with Google. I don't like to be a brand loyalist but right now, Google has, I'm really dependent on Google. They have the Google Docs, the Google Drive, Google email. It's everything in one and they all coordinate with each other. It's all attached."

Just like Bob, a "better" browser is not enough for Sandy to quit using Google Chrome. Someone needed to build a better ecosystem of web apps and services for her to consider switching away from Google Chrome.

In sum, almost everybody in the sample who used Google Chrome on their personal computers preferred the desktop browser because it was "captured" by content producers on the web. They believed that it was more efficient to use Google Chrome because the web browser was more compatible with the popular web services that they utilized.

How Chrome users started using Chrome

Not only did Chrome users justify their Chrome usage by highlighting how well-integrated the browser was with their favorite web services, but many also only started using Google Chrome because they already trusted and enjoyed using some of Google's most popular web services. For example, Toni (UCLA_14) decided to try Google Chrome because of their good experience using Gmail. Bob (UCLA_05) started using Google Chrome because it was recommended by YouTube.

Theo (UCLA_2) started using Google Chrome because it was built by the company responsible for the most legitimate (and institutionalized) search engine in the US. She started using Chrome on the family computer when the browser was first introduced because:

> Everybody used Google when we were young because it was the search engine. Then, when they came up with a web browser, I was like, "Oh, that's sick." I got Google Chrome… Just because I got so used to using the search engine and I had a really good opinion of it. I guess, I was just like, "Yes. Google's amazing. It tells me all I need to know." I was just like, "Yes. They probably have a pretty good web browser."

In other words, Theo started using Google Chrome because she "had a really good opinion" of Google's search engine. From this discussion, it was clear that Theo started using Google Chrome because it was a web browser that was "grafted" onto a legitimate search engine.

In sum, out of the 16 UCLA undergraduates that I have interviewed, 63% of them used Google Chrome on their computers because they believed it was the best web browser to access the productivity apps that they needed to access whenever they were using their computers, which were usually products that are created by Google, like Google Drive, Google Docs, and Google Sheets. A lot of these users also started using Google Chrome because they have already had a positive experience using other Google-owned services, like Google Search and YouTube. In other words, these interview findings provide support for Stovel et al. (2011)–internet users are popularly preferring to use Google Chrome as a means to connect to the larger web because it is well-integrated with their desired content producers. Not only is it the most efficient way to connect to these content producers, but it is also the "legitimate" way to access the web because it is affiliated with a legitimate and popularly utilized tool on the web.

US interview results: Non-Chrome users

According to my survey results, there are several factors that serve as deterrents to desktop Chrome usage in the US. Not only are older internet users less inclined to use Google Chrome on their desktops, but many internet users who find it important that their browser has an ad blocker and that their browser is pre-installed on their computers are also less likely to use Chrome on their desktops. According to the logistic regression model, the most important deterrent to Chrome usage is whether the internet user finds it important that their web browser respects their privacy. As the interview sample of non-Chrome desktop users is rather small, there are some discrepancies between the survey and interview results. As all of the interviewees who did not use Chrome on their desktop computers were Apple Safari users, the reason why they did not use Chrome was because Apple Safari was pre-installed on their personal computers, and they were more than happy with the most readily available option to them.

As mentioned earlier, out of the 38% of the interview participants who did not use Chrome on their desktop computers, all of them preferred to use Apple Safari as their desktop browser. All of them also used a computer that ran the Mac operating system, and they justified their web browser choice with a similar logic that people used to justified their mobile browser preferences: they never really problematized their web browser choice, and they were happily using whatever web browser that is readily available to them, which was Apple Safari. In other words, the main reason as to why these non-Chrome users found it important that their web browsers were pre-installed on their desktop computers was because they never problematized

their web browser preferences and were happy with whatever that was most readily available to them.

As the interview sample of non-Chrome users is rather small (evident in the fact that all of them use Apple Safari on their desktop computers, when there are several other viable non-Chrome web browser alternatives out there), it makes sense that the interview findings are slightly different from my survey findings. Internet users who use the other non-Chrome web browsers, like Internet Explorer or Mozilla Firefox, are not included in the interview sample.[5] As each web browser (e.g., Mozilla Firefox, Apple Safari, Internet Explorer) has different strengths and weaknesses in terms of their features, cultural connotation, and positionality in the larger material environment. The fact that users of other non-Chrome browsers (e.g., Mozilla Firefox and Internet Explorer) are included in the survey results and not included in the interview results explains why there is a discrepancy between the results.

One easy way to illustrate a clearer picture of non-Chrome usage with the data that I have collected is to construct an additional logistic regression model with the survey data, in which the outcome measure is desktop Apple Safari usage, instead of desktop Chrome usage. As shown in Table 2, the survey results on Safari usage correspond to the interview findings: one of the biggest drivers to Safari usage is whether the internet user finds it important that their web browser is pre-installed on their personal computers. It was evident from the interviews that many Apple users did not spend time problematizing the software that came with their computers

[5] As the main goal for this dissertation is to explain why most internet users prefer to use Google Chrome on their desktops, and I was able to reach saturation in the interview results on Chrome usage, I did not conduct more interviews to fully flesh out how people justify not using Chrome on their desktops. Future studies that are interested in discovering why people do not use Chrome should conduct more interviews. For a more detailed discussion on the limitations of my interviews, see Chapter 5.

(in fact some would argue these software programs, and their ease of use, are what drew them to getting an Apple device in the first place).

Table 2 - Logistic Regression Analysis of Apple Safari usage on Desktop Computers (n = 491)

	b	Std. Error	Z Value	Pr(>|z|)		Odds Ratios
Age (years)	0.003	0.019	0.170	0.864841		1.003
Gender						
Female (v. non-female)	-0.022	0.488	-0.045	0.964075		0.978
Education						
College (v. no-college)	-0.117	0.524	-0.223	0.82382		0.890
Tech news consumption						
At least a few times a week (v. less than)	-1.061	0.527	-2.012	0.044249	*	0.346
Opinions on browser features						
Important to have an Ad-blocker (v. not)	-0.324	0.548	-0.592	0.553906		0.723
Important to not track and share personal info (v. not)	0.333	0.538	0.618	0.536578		1.394
Important to be well-integrated with favorite web services (v. not)	0.579	0.789	0.734	0.462733		1.785
Important to come pre-installed in computer (v. not)	2.076	0.539	3.853	0.000117	***	7.971
Opinions on tech companies and internet						
Trusts US tech to handle personal info (v. would not)	0.001	0.728	0.002	0.998691		1.001
Believes that ISPs will look out for their best interests (v. does not believe)	-1.388	0.772	-1.798	0.072236	†	0.250
Agrees that ISPs should be able to share their data (v. does not agree)	0.491	0.722	0.681	0.496026		1.635
Agrees that internet tech should be owned by one company (v. does not agree)	-1.682	0.895	-1.879	0.060205	†	0.186
Agrees that consumers should be able to freely access any content they want on the internet (v. does not agree)	0.542	0.810	0.669	0.503379		1.719
Constant	-3.927	1.330	-2.952	0.003159	**	0.020
Model chi-square =	27.453	p < 0.05				

† p<.10 * p <.05 ** p < .01 *** p < .001 (two-tailed tests) ; standard errors are presented in parentheses.

Note: The dependent variable in this analysis is coded so 0 = does not use Safari on personal computer and 1 = use Safari on personal computer.

However, if the goal is to investigate why people do not use Google Chrome on their desktop computers, more interviews would be needed to comprehensively capture the motivations, behaviors, and attitudes of more internet users, especially those who preferred to use other web browsers, like Mozilla Firefox and Internet Explorer.

Conclusion

In this chapter, I captured how internet users in the US chose their web browsers through a series of interviews and surveys. Through my online survey, I found that desktop Chrome users in the US were significantly different than non-Chrome users. Not only were they different in terms of demographics and how they thought about tech companies and the larger internet, but they were different in terms of feature preferences for their desktop browsers. Specifically, Chrome users found it more important that their web browsers were well-integrated with their favorite web services, whereas non-Chrome users found it more important that their browsers had ad blockers, respected their privacy, and came pre-installed on their computers. According to a logistic regression model, both cultural and material factors served as statistically significant predictors of desktop Chrome usage. However, the strongest predictor for Chrome usage is whether the internet user finds it important that their web browsers are well integrated with their favorite web services. On the other hand, internet users who found it important that their web browsers had ad blockers and respected their privacy were significantly less inclined to use Google Chrome on their desktops.

My interview findings provide a possible explanation as to why internet users who found it important that their web browsers are well-integrated with their favorite web services were more inclined to use Google Chrome on their desktops. As people usually turned to their desktop/laptop computers for tasks pertaining to school and work, and since many of them used web services owned and operated by Google for these tasks (e.g., Gmail, Google Drive, Google Docs), they preferred to use Google Chrome for these tasks because they thought it was the most efficient way to engage with these resources. In other words, American internet users preferred to use Google Chrome on their desktops because of the browser's structural position in the

material environment, in which it is a broker that is captured by the content producers. This finding provides support for Stovel et al. (2011), and it illustrates how American internet users do not need a browser that is "captured" by them (or content consumers), they are fine using one that is "captured" by those who are responsible for content on the web because they value the efficiency associated using a web browser that is captured by the "other side."

Interestingly, the justifications that people employed to explain their web browser preferences on their mobile phones was different from how they justified their desktop web browser preferences. As people more frequently use their phones for tasks that do not pertain to their work or school, and the fact that many of the web services they frequent on their phones have their own dedicated mobile apps, most people used their mobile browsers as search engines for quick and usually trivial questions that they encountered in their daily lives. Almost everybody I interviewed used whatever web browser that came pre-installed on their phones because it was "good enough" for the quick search tasks designated for their mobile browsers. In other words, web browsers that are in the structural positions of being the most readily available are the ones that people prefer on their phones, which provides support for Small (2013; 2017) and Small and Sukhu (2016).

By examining both how internet users choose their web browsers on their desktops and their phones, I show how both cultural and material factors contributed to Google Chrome's popularity on American internet users' desktops. In the next chapter, I report my findings from my surveys and interviews in China to explore why Chinese internet users popularly prefer to use Chrome on their desktops as well.

Chapter 4. Chinese internet users and their Google Chrome usage

In this chapter, I describe how internet users in China have justified their web browser choices by reporting results from a series of interviews and surveys, in which I directly inquire about their choices and their general online behavior. According to my interviews and surveys, I found four major differences between Chinese internet users who use Chrome on their personal computers and those who do not use Chrome on their personal computers: 1) A larger proportion of Chrome users found it important that their browsers respected their privacy; 2) a larger proportion of Chrome users trusted western tech giants to handle their data; 3) a larger proportion of Chrome users agreed that people should be able to freely access any content on the internet; 4) Chrome users were more educated and younger than non-Chrome users.

From my survey data, I also found that the strongest predictor of Chrome usage in China is whether the internet user has a college degree. The interview data provides some insights as to how that is.

Below, I first describe my survey sample, instrument and results, and then I discuss the interviews I conducted in China to explain the trends that were observed in my survey data.

CN survey

Just like the survey study conducted in the US, I also designed, fielded, and analyzed an online survey that captured the self-reported online behaviors of 411 adults in China. The survey instrument, built and hosted on SurveyGizmo, is a Chinese translated version of the US survey, in which the goal is to capture why internet users in China popularly prefer to use Google

Chrome as their web browsers on their computers by asking a series of questions that cover the following topics:

6. How participants chose their preferred web browser.
7. The most important features of a participant's preferred web browser.
8. A participant's attitudes and beliefs regarding the internet and the largest tech firms that facilitate internet behaviors.
9. A participant's level of proficiency and interest in technology and computer programming.
10. Demographic characteristics of the participants, including age, race, gender, and level of education.

CN survey sample

In China, participants were recruited via a panel service provided by Cint that was accessed from SurveyGizmo. Cint is an insights exchange platform that maintains a global consumer network of over 50 million people. Cint's respondents opted-into their network by answering a questionnaire about their demographics, hobbies, consumer habits, work experience, household statistics, medical conditions, etc. Respondents are also re-profiled every 6 to 12 months to ensure that their profiling remains accurate. For this study, I ensured that my participants were Chinese residents that were at least 18 years of age with regular internet access.

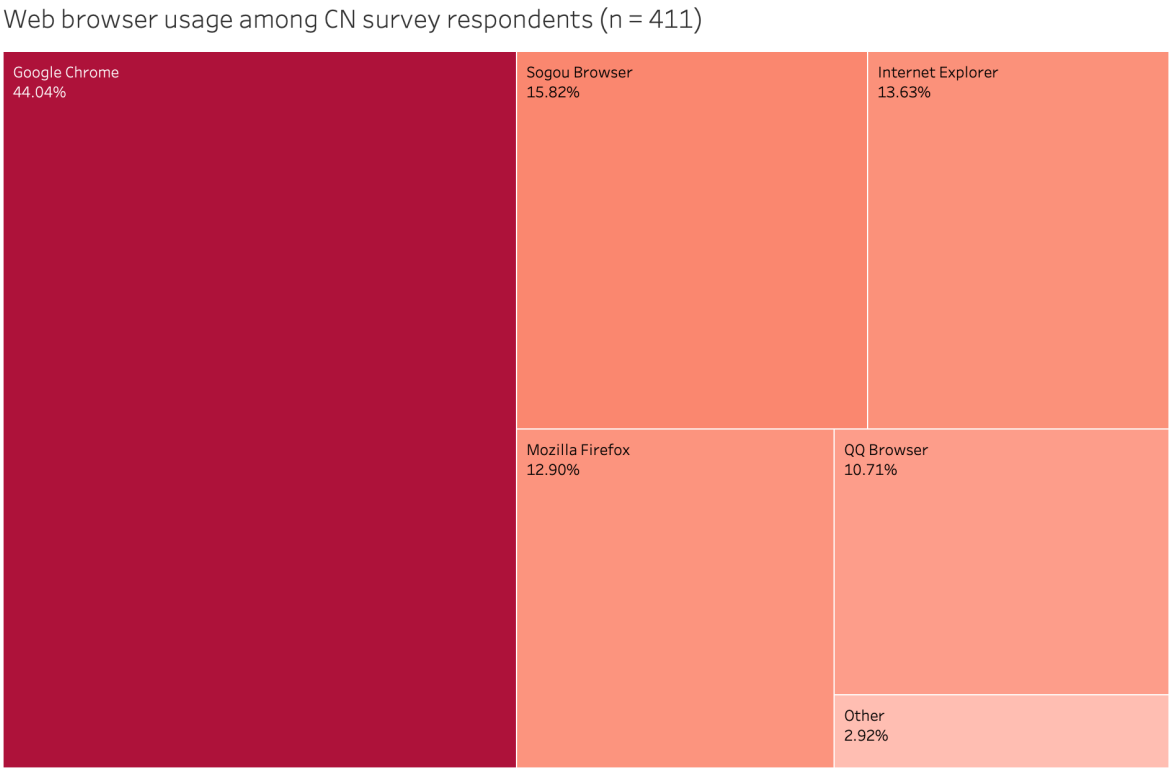
Similar to online crowd-sourcing platforms, like Amazon's Mechanical Turk and ZBJ.com, it has been shown that the populations who participate in these platforms are not nationally representative as they over-represent people who have regular internet access (Berinsky et al. 2012; Buhrmester et al. 2011). This bias should work in the favor of my research

design since I am interested in the preferences of those who are familiar and comfortable with using the internet.

The Chinese sample had a total of 411 participants (201 females, 210, non-females). Participants were all Chinese residents ranging in age from 18 to 69 (Median = 31, SD = 8.25). Out of the 411 participants, 80.29% of them had at least a college degree.

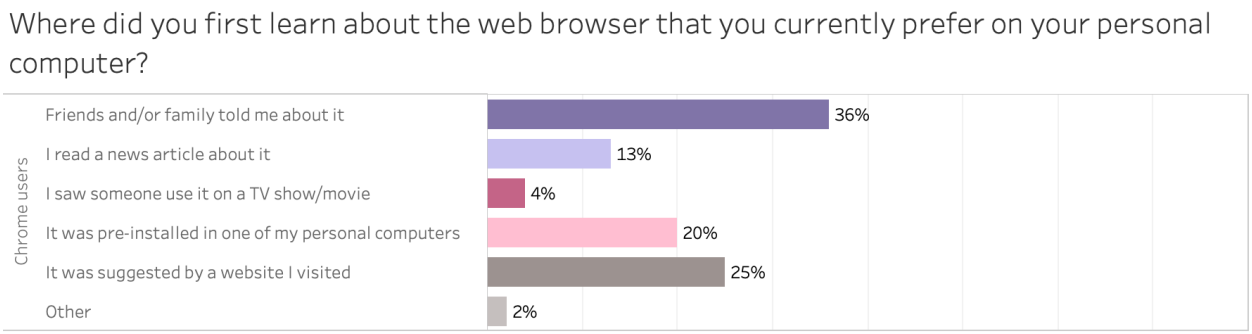
CN survey results

From the survey results, one could see that Google Chrome was indeed the most popular desktop browser among the survey sample in China. As shown in Figure 10, 44% of the survey participants preferred to use Google Chrome on their computers, 15.82% preferred to use Sogou Browser, 13.63% preferred to use Internet Explorer, 12.90% preferred to use Mozilla Firefox, and 10.71% preferred to use the QQ Browser on their computers.



[Figure 10. Web browser usage amongst CN survey sample (n = 411)]

Among those who preferred to use Chrome on their desktops, most of them first learned about Chrome from their friends and/or family (36%). However, there is a sizable chunk of survey respondents who learned about Chrome through a website that they have visited (25%). A lot of people also first learned about Chrome because it was pre-installed on their personal computers (20%). As computer vendors in China and Asia are inclined to install software programs on the computers they sell, it seems like many were exposed to Google Chrome because Chrome came pre-installed on the computers they bought.

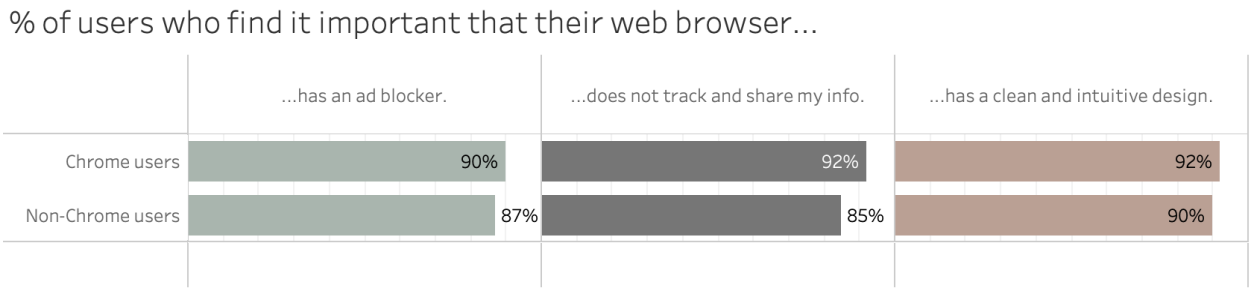


[Figure 11. How CN survey sample first learned about their web browser (n = 181)]

Among the survey sample, I observed four major differences between Chrome users and non-Chrome users along the following axis: 1) web browser feature preferences; 2) attitudes towards Western tech firms; 3) attitudes about the internet; and 4) demographics. I detail these four differences below:

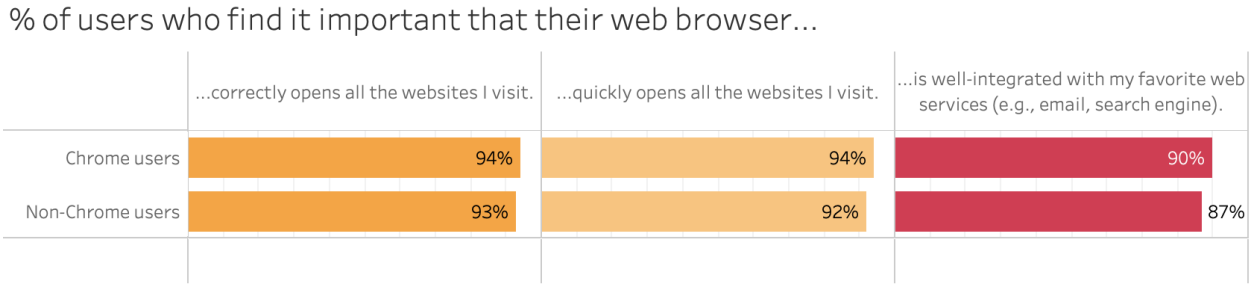
Web browser feature preferences

Out of the six web browser features investigated in this survey, I found that Chrome users were only statistically different from non-Chrome users in how important it was that their web browser respected their privacy. According to a two proportions z-test, the proportion of Chrome users (92%) who found it important that their web browsers do not track and share their info was significantly greater than the proportion of non-Chrome users (85%) who felt the same way (see also Figure 12). Although it seems like there was a slightly larger proportion of Chrome users in China that valued the other web browser features that benefitted the regular internet user, none of these differences are statistically significant at a 95% confidence level.



[Figure 12. How Chrome users in China value consumer capture features (n = 411)]

There was also a slightly larger proportion of Chrome users in China that valued web browser features that benefitted those who produce content online. However, none of these differences are statistically significant.



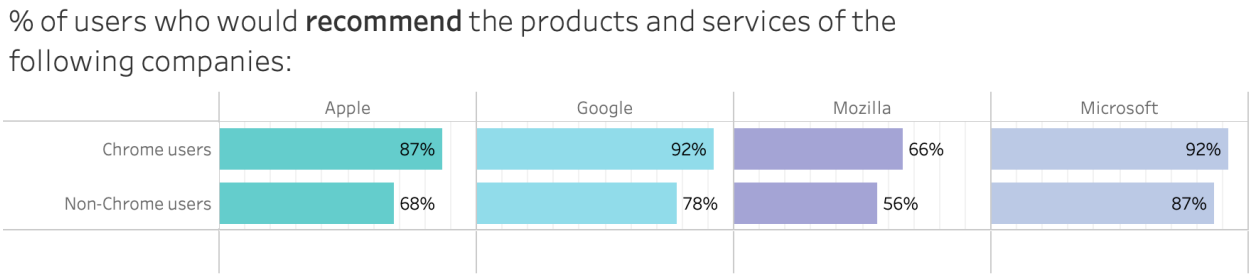
[Figure 13. How Chrome users in China value producer capture features (n = 411)]

In sum, Chrome users were slightly different from non-Chrome users in their preferences for web browser features. There was a larger proportion of Chrome users that found it important that their web browsers respected their privacy. This difference provides some support that Chrome users may be more inclined to use Google Chrome in China because it is a broker that is

"captured" by internet users–the browser is more on the side of the regular consumer, not those who provide services and content on the web.

Attitudes towards American Tech Firms

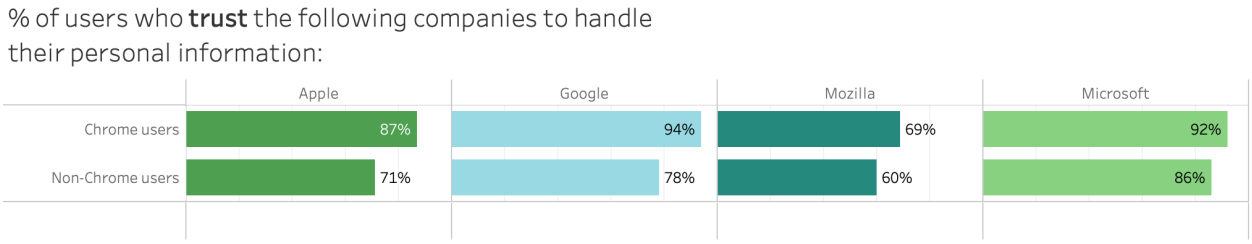
One of the major differences between Chrome and non-Chrome users in China was their attitudes towards American tech companies with services that have been "legally" available in China. A larger proportion of Chrome users had positive feeling towards American tech firms than non-Chrome users.



[Figure 14. Percentage of Chrome Users in China who would recommend the services and products of tech companies from the US (n = 411)]

Even though it makes sense that a larger proportion of Chrome users (92%) would recommend the products and services of Google than non-Chrome users (78%) since it is the company responsible for their preferred web browser, a much larger proportion of Chrome users also recommended the products and services of other American tech firms, as shown in Figure 14. Compared to non-Chrome users, there were significantly more Chrome users that would recommend the services and products of Apple (87% of Chrome users vs. 68% of non-Chrome

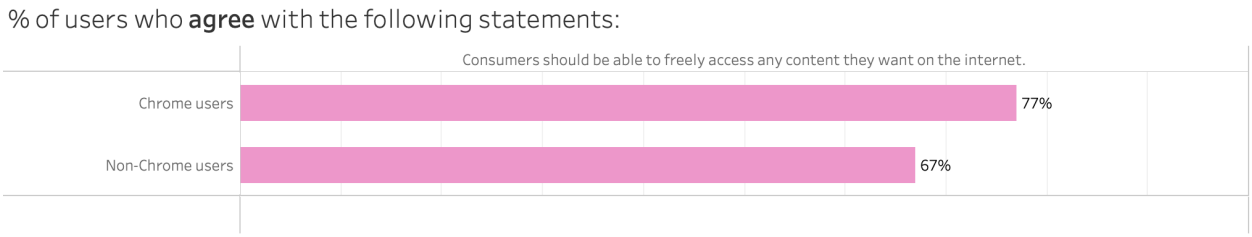
users), Mozilla (66% of Chrome users vs. 56% of non-Chrome users), and Microsoft (92% of Chrome users vs. 87% of non-Chrome users). Similarly, there was also a larger proportion of Chrome users, than non-Chrome users who trusted Apple, Google, Mozilla, and Microsoft to handle their personal information, as shown in Figure 15. All in all, Chinese Chrome users tend to have more favorable opinions regarding the largest American tech firms that were still "legally" available in the country.



[Figure 15. Percentage of Chrome Users in China who would trust tech companies from the US to handle their data (n = 411)]

Attitudes regarding the Internet

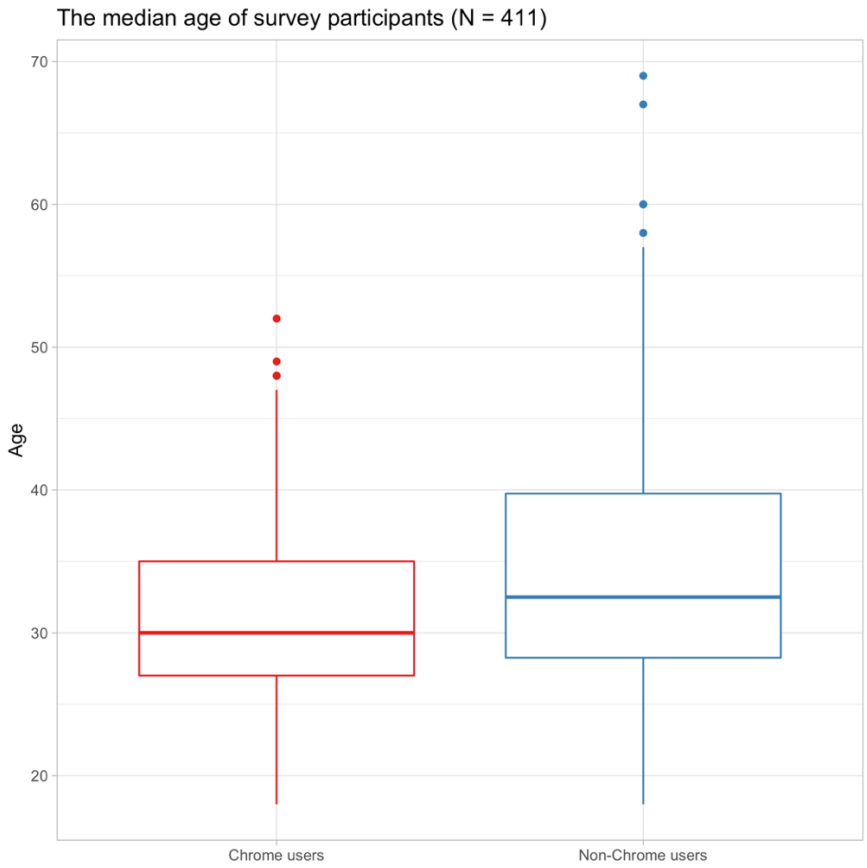
In addition to holding different opinions about western tech firms, a larger proportion of Chrome users in China also believed that all online content should be freely accessible to internet users. As shown in Figure 16, 77% of Chrome users agreed that consumers should be able to freely access any content on the internet, whereas 67% of non-Chrome users felt the same way. This difference is statistically significant at a 95% confidence level according to a two proportions z-test.



[Figure 16. Percentage of Chrome users in China who believe internet access should be free (n = 411)]

Demographics

Lastly, there were demographic differences between Chrome and non-Chrome users among the China survey sample. Chrome users were younger and more educated than non-Chrome users in China. According to Figure 17, the median age of Chrome users was 30 (Mean = 31.12, SD = 6.71), whereas the median age of internet users who did not use Chrome was 32.5 (Mean = 34.25, SD = 9.055). There were also significantly more users who have received at least a college education among Chrome users. Around 90% of Chrome users had at least a college degree, whereas 72.61% of non-Chrome users had at least a college degree.



[Figure 17. The median age of CN survey participants (n = 411)]

Which factors are most significantly associated with Chrome usage?

To capture which of the factors above is significantly associated with desktop Chrome usage in China, I constructed a logistic regression model, in which the outcome measure is a binary variable indicating whether someone uses Google Chrome on their computer or not. The predictors in the model are mostly from the variables identified above, which include: 1) the demographics of the internet user; 2) an internet user's opinions on browser features; and 3) internet users' opinion on western tech companies and the internet. The results for this model are shown in Table 3.

According to Table 3, Chrome usage is significantly associated with demographic factors, such as age and education. A one-year increase in an internet user's age decreases the odds of Chrome usage by a factor of 0.962. Going from not having a college education to having a college education increases the odds of Chrome usage by a factor of 2.737.

An internet user's opinions on tech companies is also significantly associated with Chrome usage as well. Going from not trusting the four western tech companies that "legally" provide services (i.e., Apple, Google, Mozilla, and Microsoft) to trusting the four western tech companies increases the odds of desktop Chrome usage by a factor of 2.070.

At a 95% confidence level, going from finding it unimportant that their web browser is preinstalled on their computers to finding this important decrease the odds of desktop Chrome usage by a factor of 0.506. There aren't any other significant relationships between variables associated with internet users' opinions on web browser features and desktop Chrome usage.

Table 3 - Logistic Regression Analysis of Google Chrome usage on Desktop Computers in CN (n = 411)

	b	Std. Error	Z Value	Pr(>|z|)		Odds Ratios
Age (years)	-0.038	0.014	-2.663	0.008	**	0.962
Gender						
Female (v. non-female)	-0.065	0.220	-0.295	0.768		0.937
Education						
College (v. no-college)	1.007	0.319	3.157	0.002	**	2.737
Tech news consumption						
At least a few times a week (v. less than)	-0.042	0.303	-0.139	0.890		0.959
Opinions on browser features						
Important to have an Ad-blocker (v. not)	-0.056	0.370	-0.15	0.880		0.946
Important to not track and share personal info (v. not)	0.601	0.362	1.662	0.096	†	1.825
Important to be well-integrated with favorite web services (v. not)	-0.071	0.368	-0.192	0.848		0.932
Important to come pre-installed in computer (v. not)	-0.682	0.244	-2.8	0.005	**	0.506
Opinions on tech companies and internet						
Trusts US tech to handle personal info (v. would not)	0.727	0.248	2.933	0.003	**	2.070
Trusts CN tech to handle personal info (v. would not)	-0.445	0.251	-1.774	0.076	†	0.641
Believes that ISPs will look out for their best interests (v. does not believe)	-0.188	0.241	-0.779	0.436		0.829
Agrees that ISPs should be able to share their data (v. does not agree)	-0.009	0.265	-0.034	0.973		0.991
Agrees that internet tech should be owned by one company (v. does not agree)	0.055	0.268	0.204	0.838		1.056
Agrees that consumers should be able to freely access any content they want on the internet (v. does not agree)	0.467	0.254	1.84	0.066	†	1.595
Constant	-0.180	0.801	-0.225	0.822		0.835
Model chi-square =	59.840	p < 0.05				

† p<.10 * p <.05 ** p < .01 *** p < .001 (two-tailed tests) ; standard errors are presented in parentheses.

Note: The dependent variable in this analysis is coded so 0 = does not use Chrome on personal computer and 1 = use Chrome on personal computer.

In sum, internet users in China are more inclined to use Chrome on their desktops if they are younger and if they have a college education. Those who trust Apple, Google, Mozilla, and Microsoft to handle their personal information are also more inclined to use Google Chrome on their desktops. However, those who value having their web browsers pre-installed on their computers are less inclined to use Google Chrome on their desktops.

In the next section, I discuss the interview protocol, sample, and results as a means to identify possible reasons as to why demographic factors like age and college, along with trust in

the major American tech companies, are significantly associated with desktop Chrome usage among the survey sample.

CN interviews

To explore how Chinese internet users choose their web browsers, and why most of them prefer to use Google Chrome on their desktops, I conducted 16 semi-structured interviews in Shanghai. Utilizing a convenience and snowball sample, I recruited college students from East China Normal University, in which interview participants were recruited via fliers and email announcements in undergraduate clubs during the Spring of 2018.

Just like the survey (and the interviews conducted in the US), the interviews explored how my participants went online. Specifically, I asked them a series of questions regarding their web browser usage. Not only did I ask questions pertaining to how they used their web browsers, I also asked them to recall their thought process when they first used their web browser of choice. Lastly, I asked a couple questions capturing their views and attitudes towards the various web browsers that were currently available in the market. The goal for these interviews was to identify why most of my interview participants popularly preferred to use Google Chrome on their desktop computers.

Unlike the survey, all interview questions were open-ended, so respondents were able to explore their behaviors and feelings using their own words. The interview transcripts were transcribed before they were coded using ATLAS.ti.

CN interview sample

Among the 16 interview participants, 12 identified as females and 4 identified as male. Not only did I recruit a wide range of students in terms of age (some were about to graduate college, while others were incoming first years), but they also owned and used a diverse set of devices. iPhone users made up 44% of the interview sample, and 13% of participants had a personal computer that ran MacOS.

Google Chrome was the most popular web browser amongst the interview sample. 38% of interview participants preferred Google Chrome on their computers, whereas 25% preferred Internet Explorer, 13% preferred Mozilla Firefox, and 6% preferred to use Apple Safari. 19% of the interview sample preferred to use other "homegrown" Chinese browsers (like, Sogou, 360, and QQ Browser). During my interviews, I explored why Chrome users were drawn to using Google Chrome on their desktop computers.

CN Interview Results: Why Chrome on the desktop?

As identified in the survey study, internet users in China were more inclined to use Google Chrome on their desktops if they were younger and if they received a college education. Those who trusted American tech companies (i.e., Apple, Mozilla, and Microsoft) to handle their personal information were also more inclined to use Chrome on their desktops, whereas those who trusted Chinese tech companies (i.e., Alibaba, Baidu, Tencent, and Xiaomi) were less inclined to use Google Chrome on their desktops. To identify possible reasons as to why these associations exist, I turn to my interview results in China. Below, I detail why Chrome usage is associated with college education and attitudes regarding western and eastern tech companies.

College education and Chrome usage

As college education is one of the strongest predictors for Chrome usage among the survey sample in China, I also found that all of the desktop Chrome users among the ECNU interview sample only started using Chrome on their desktops after they got to ECNU for college. Almost all of them (except for one) decided to download Chrome because they had difficulty accessing the university's websites, specifically the library databases they needed for schoolwork and the registrar's websites for course enrollment. For example, Jane (ECNU_8) was perfectly happy using the web browser (Safari) that was pre-installed on her MacBook, until she had to access the school's public databases:

"[I downloaded Chrome] when I realized that the browser that I have pre-installed in my MacBook cannot access the school's public databases."

Jane did not start using Chrome on their desktop computers until they realized their pre-installed browsers had difficulty accessing the websites they needed to use for school. In fact, this was such a common problem that ECNU itself actually recommended their students to download either Mozilla Firefox or Google Chrome for the most reliable access to the school's resources, according to Beth (ECNU_14):

"Safari works fine when you are accessing the library website, but there are issues when you access the public databases. Although I did not know at the time, our school actually recommends that we use Chrome to access the databases."

Although Jane, Sam, and Beth all started using Google Chrome because they realized that their pre-existing browser on their computers couldn't open the websites they needed to succeed in school, how did all of them actually turn to Chrome, especially since ECNU's official websites also recommended Mozilla Firefox as a possible browser that is compatible with their sites? Almost all of the Chrome users I interviewed (except for one) decided to try Google Chrome because their fellow (usually older) college classmates and/or friends recommended that they should use it. Not only was this institutional knowledge a big driver in turning people to Chrome, but it was also common to see students who use Chrome talk about the browser and its maker, Google, in favorable terms, which I detail in the next section.

Chrome usage and attitudes towards tech companies

Similar to the results found in the survey sample, ECNU students who used Google Chrome also usually held positive opinions about western tech companies, especially Google, while holding strong negative opinions about Chinese tech companies.

One of the most common justifications of desktop Chrome usage that I heard during the interviews was that Chrome was very "clean" and "comfortable" to use when browsing the web, especially in comparison to the other browsers on the market. According to Paul (ECNU_2),

"[I decided to start using Chrome] because of the clean and simple design of the browser."

He gravitated towards Chrome due to the aesthetics of the browser. Although it is true that Chrome's browser has a very minimalistic design, what a lot of my interviewees, including Paul,

were referring to when identifying this "clean and simple design" is the lack of advertisements and notifications that other web browsers, especially ones made by Chinese tech companies (Qihoo 360, UCWeb, and Tencent), have embedded in their browsers. When I pushed Paul further to explain what he meant by the design of Chrome, he described the process of how he switched from the UC Browser to Chrome:

"You probably don't understand…and even now I think UC [browser] is still the most popular mobile browser in China. However, the browser now is populated with a lot, A LOT of advertisements and 'portal links' (流量入口). If it weren't for all these messy [add-ons], UC is pretty easy to use browser…[However, I switched to Chrome] because there are just too many advertisements."

Paul's preference for Google Chrome, which was due to the browser's much cleaner and streamlined user interface (especially compared to locally grown browsers, like UC Browser), is echoed by Dave (ECNU_7). Dave thought that the most popular browsers in China were Google Chrome and the 360 Browser. He explained:

"[I think people like using Chrome] because its fast…Occasionally, [me and my friends] would talk about web browsers, and we usually conclude that Chrome is fast, and its comfortable to use, the user interface is comfortable. 360 [browser] is really annoying. But 360 isn't bad because the core is similar [to Chrome]…and it opens websites quickly as well, plus 360's anti-virus software has a very good reputation, even though it is plagued with advertisements and notifications, like the [360] browser."

In this statement, Dave admitted that both Chrome and the 360 browser could open websites quickly. However, the major difference between the two (which was also why he preferred to use Chrome himself) was that Chrome had a comfortable to use interface. It wasn't "annoying" like the 360 interface, which was plagued by an excess of advertisements and notifications.

Not only did people like Chrome because of its comparatively simple and clean aesthetic design, but as indicated in Paul and Dave's discussion of Chrome's competition, many of the Chrome users held pretty negative opinions about web browsers made by Chinese tech companies. In addition to finding them "annoying" for being mucked up by advertisements, pop-ups, and unwanted portal links, Chrome users also found the way these companies marketed their browsers distasteful. For example, when discussing the popularity of the 360 Browser, Paul described the browser as a "gangster software" ("流氓软件") because when you downloaded anything that was made by Qihoo 360, including their browser, it would force the user to download all the other software programs made by the company to achieve a phenomenon, called "whole family synced" ("全家統"):

"全家統 (whole family synced) is a Chinese internet phenomenon where once you download one software from a company, the company will force you to download all of its software products… 360 is one of the first companies that used this strategy. Super gangster."

Qihoo 360 wasn't the only Chinese tech company that Chrome users found distasteful due to its marketing strategies. When I asked Chrome users to speculate why they think QQ Browser was the third most popular web browser in the country, almost all of them attributed the browser's

popularity to its marketing strategy, without any discussion of the features or strengths of the browser. For example, when asked about the QQ Browser, Jennifer (ECNU_13) stated:

"[I think people like using QQ Browser because of] Tencent. A lot of people use QQ [messenger] or Tim, and if you need to open certain files [when using those chat apps]…it will ask you to download the QQ Browser to more quickly open the files."

Instead of identifying how the QQ Browser could potentially have features that were sought after by internet users, Jennifer stated that the reason why people used QQ was because users were pushed to use it after using Tencent's other popular software programs (e.g., QQ [messenger] and Tim). This sentiment was echoed by Beth (ECNU_14):

"[I think people like using QQ Browser because] people use a lot of Tencent's software, and all of these programs will recommend things to their users, like QQ anti-virus and QQ Browser, and I think a lot of people accidentally install these programs when they see them, like me."

Although Beth preferred and mostly used Google Chrome on her desktop, she also had the QQ Browser installed on her computer, and she thought that most people have the QQ Browser on their devices because they "accidentally" installed the program when using Tencent's other applications.

The belief that people were not intentionally downloading and using Tencent's QQ software was also articulated by Jane (ECNU_8):

"I think Windows users may be using QQ browsers because when they installed QQ/WeChat on their computers, [Tencent will] force the computer to install the browser as well for whatever reason."

Instead of attributing QQ Browser's popularity to people intentionally seeking out and wanting to use the browser, Jane speculated that many internet users used the QQ Browser because they were "forced" to download and install the browser after using Tencent's popular QQ (messenger) and WeChat.

In sum, the interview findings from ECNU provide a possible explanation as to why college-educated internet users who have favorable views of Western tech companies and unfavorable views of Chinese tech companies are more inclined to be desktop Chrome users. Almost all of the interviewees who used Chrome only started using the browser because their pre-existing (pre-installed) browsers on their computers could not open the websites they needed to for school purposes. When justifying why they gravitated towards Chrome, Chrome users among the interview sample commonly argued that it had a user interface that was not littered with advertisements, notifications, and "portal links," like a lot of the Chinese browsers that they were familiar with. Not only did they think the Chinese browsers were contaminated with unwanted features and content, but they also thought a lot of the popular Chinese browsers (e.g., 360 Browser and QQ Browser) became popular because of the "gangster" marketing strategies employed by their makers, they believed that internet users who use the other popular applications from Qihoo 360 (e.g., their anti-virus software) and Tencent (e.g., their extremely popular QQ messenger) were forced or tricked into downloading their browsers as well.

CN interview results: Why not Chrome on the desktop?

My interview results also indicated that those who found it important that their web browsers came pre-installed on their desktop computers were less likely to use Chrome on their desktops. Although Google Chrome was the most popular web browser amongst the interview sample, 63% of the students I interviewed did not use Google Chrome. Almost all of them just used whatever web browser that came with their desktop computers. Not only were they less likely to discuss the faults of Chinese tech companies (e.g., Tencent and 360), but they never really problematized their web browser, and were usually perfectly satisfied with the browser they had because they believed the experience that their web browser was providing was fine the way it was. Especially amongst those who used Internet Explorer, Apple Safari, and 360 Explorer, they all articulated a similar logic as to why they used the browser they had—the browser came pre-installed on their computers and it did what they wanted the browser to do. They never had any explicit difficulty opening the websites that they frequented on the web.

Among those who did not use Google Chrome on their desktops, two students used Mozilla Firefox, and they were the only ones who articulated a different logic. Similar to those students who first started using Google Chrome because they had an issue opening school websites using their pre-installed web browser, these Firefox users also only started using Firefox because they encountered a similar issue. It just so happens that the friends and resources that they consulted to solve this issue suggested that they download Mozilla Firefox.

In sum, the majority of non-Chrome users (outside of the ones who used Mozilla Firefox) used their browser of choice because it was the most readily available option to them. The reason why they never thought about using another browser was because the one that they had pre-installed on their computers already did everything that they wanted. Unlike the Chrome users in

the sample, these non-Chrome users also rarely voiced any concern about the aesthetics about the browser that they were using, nor were they concerned about the "gangster" marketing strategies commonly employed by Chinese tech companies. The interview findings provide a possible explanation as to why most non-Chrome users find it important that their web browsers come pre-installed on their computers. The internet users who did not use Chrome on their desktop did not have an explicit reason to try out something that was different from their pre-installed browser because their pre-installed browser did everything that they needed it to do.

Conclusion

According to the interviews and surveys that I conducted in China, I found that there were several possible reasons as to why Chinese internet users popularly preferred to use Google Chrome on their desktops, which were associated with the internet users' demographics and their attitudes and beliefs regarding the internet and tech companies that facilitated their online behaviors.

One of the strongest predictors of desktop Chrome usage in China is whether the internet user has a college education. According to my interviews with Chrome users at ECNU, I found that this significant association may be observed because almost all of them were perfectly content using the web browsers that were pre-installed in their desktops until they came to college. As many of them encountered difficulty opening school websites with their pre-existing browser, like registering for classes or accessing the school library's databases, many of them decided to download and use Google Chrome after they learned about the browser from their fellow classmates and friends. For certain school resources, Google Chrome was actually explicitly recommended to students as a more reliable way to access these sites. Without coming

to college, and being required to accomplish these tasks for school, these students may never have encountered a reason to turn to Google Chrome as a browser for their desktops.

In addition to receiving a college education, internet users who trusted American tech companies and distrusted Chinese tech companies are also more inclined to use Google Chrome on their desktops. From the interviews, I learned that many internet users turned to Google Chrome because they held more negative feelings about the web browsers made by Chinese tech companies. When trying to justify their Chrome usage, they often cited the browser's minimalistic design that was different from browsers that were littered with unwanted features and advertisements, like UC Browser and 360 Browser. Chrome users also disapproved the way Chinese tech companies, like Tencent, marketed their software programs. All of the Chrome users I interviewed attributed QQ Browser's popularity in the Chinese market to the marketing strategy that Tencent used for the browser. Chrome users thought that people may have been forced to download (or accidentally tricked into downloading) the browser when using Tencent's popular chat apps. None of the Chrome users entertained the possibility that QQ Browser may have had some features that were attractive to certain users. All in all, Chrome usage in China is associated with how the internet user feels about American and Chinese tech companies that facilitate their internet behaviors.

As web browser choice and usage can be framed as a social action that is enabled and constrained by mutually sustaining cultural schemas and resources (the social structure that the actor is embedded in), it is shown through my surveys and interviews that cultural schemas play an important role in driving people to using Chrome on their desktops in China. In this context, web browser choice seems to be more like a consumption choice. Not only are Chrome users in China different from non-Chrome users, in terms of their social class and background

(specifically, their levels of education and age), but Chrome users also hold different values and beliefs (specifically about tech companies) than non-Chrome users in China. Although both Chinese and American internet users popularly prefer to use Google Chrome as their browser of choice on their desktops, the fact that cultural schemas are the main driving force to Chrome usage in China is different from how American users are driven to use Chrome on their desktops. In the next concluding chapter, I provide a more in-depth comparison of how American and Chinese internet users articulated two different sets of logics to popularly make the same choice: use Chrome on their desktop computers.

Chapter 5. Conclusion

In this dissertation, I explain how Google came to dominate the web browser markets in the US and China. By framing web browser choice as a social action that is embedded in a social structure that consists of mutually sustaining cultural schemas and material resources, I have identified the most important factors that drive internet users' web browser preferences in the two countries. Specifically, I found that Chrome became the most popular web browser in the US because of cultural and material factors: In addition to historically presenting itself as a browser that promotes the free and open web, Google Chrome has enjoyed the advantage of being part of an ecosystem of popular web apps and services. A lot of American users gravitate towards the browser because they think it is the best way to access Google's ecosystem. On the other hand, Chrome's popularity in China is mostly due to cultural factors: Internet users who are more highly educated, while also holding more positive opinions about Western tech companies and more negative opinions about Chinese tech companies are more likely to use Google Chrome.

This chapter is organized in the following manner: I first discuss the American findings from Chapter 2 and Chapter 3, then I describe the Chinese findings from Chapter 4. Then, I provide possible explanations as to why Google Chrome's popularity in the two countries are attributed to different factors. I conclude the dissertation with a discussion of the limitations and implications of this study.

US discussion

Ever since the "internet" has become popularly available and utilized in the US, the country's desktop web browser market has mostly been dominated by a single web browser. Before 2013, Microsoft's Internet Explorer dominated the web browser market by taking advantage of its structural position. Since Microsoft Windows was the most popular computer operating system during this time, the fact that Internet Explorer was the most readily available browser that came pre-installed in most people's computers helped make it become the most popular desktop web browser before 2013.

After 2013, Google was able to become the most popular web browser because of cultural and material factors (for more details, see Chapter 2). In the cultural environment, Google made an explicit effort through a series of advertising and marketing campaigns to position itself as the "anti-Microsoft" as Microsoft's reputation, at least among those who are early adopters of the internet, was tarnished by its long-lasting antitrust legal battle with the DOJ and Netscape. When introducing Google Chrome to the public, it framed the product as a passion project with the goal of ensuring that the web remains free and open source. Not only was Chrome free to use and that anybody can access and modify its source code, but they also released the browser with the hopes of elevating the web into a system of interactive applications, in which the browser would be the platform to access these applications. In other words, Google had a cultural reputation that made its products desirable to use, especially among "techno-elites and hackers" who are passionate about the Web (Castells 2003).

Importantly, Google also leveraged its structural position to take over the desktop web browser market in 2013. In addition to taking advantage of the outcome of the Microsoft antitrust litigation, in which Google was able to have the Chrome browser pre-installed on the laptops

from companies, like Sony, it also made a deliberate effort to ensure that the browser was an efficient gateway to the utilities and applications that people most frequently use on the web, which were often owned and operated by Google (e.g., Google Search, Gmail, YouTube). In practice, Google used their popular suite of apps to nudge users to switch to Google Chrome, with explicit notifications telling users that Google Chrome was the best way to engage with these sites.

Google's strategic positioning in the macro material and cultural environments created a perception among internet users that that Google Chrome was the best way to access Google's suite of web services and applications, and these attitudes and beliefs were captured in the surveys and interviews conducted in 2018 (see also Chapter 3). From the survey results, I found that one of the most important predictors for desktop Chrome usage was whether the user finds it important that their web browser was well-integrated with their favorite web services (e.g., search and email), along with demographic factors, like age and gender, and opinions regarding internet service providers. People who wanted a web browser that allowed them to easily and effectively access their favorite web services were more inclined to use Google Chrome on their desktops. On the other hand, internet users who found it important that their web browser protects them from ads and respects their privacy were more inclined to use a browser that was not Google Chrome.

The interview results provide an explanation as to why internet users who thought it was important that their web browsers were well-integrated with their favorite web services were more inclined to use Google Chrome. No matter the hardware and computer operating system the interviewees had, those who used Chrome on their desktop computers only used their computers when they needed to do something for work or school. As these tasks often involved

accessing websites and services that were owned by Google, like Gmail, Google Drive, and Google Docs, they found it important to have a browser that they thought was the best way to access these sites. To these internet users, it did not matter whether Google had a robust ad blocker, or whether the browser did not track and/or share their browsing info, they liked using Google Chrome because they believed it was the best way to engage these web apps that they needed to use for school and work.

The US results also highlighted possible explanations as to why internet users were dissuaded from using Google Chrome on their desktops. As each Chrome alternative has their unique strengths and weaknesses, and different positions in the cultural and material environment, the reasons as to why people gravitated away from Chrome were different contingent on what browser they preferred using on their computers. For example, those who used Mozilla Firefox tend to be internet users who cared more about their privacy, whereas those who used Apple Safari tend to be internet users that found it important that the software programs they used were all pre-installed on their computers. These justifications generally corresponded to how Mozilla and Apple have historically positioned themselves in the macro cultural and material environment, with Mozilla being a non-profit organization with the goal of ensuring a free and open web, and Apple being a company that is known to sell all-in-one, easy-to-use computer packages to consumers.

From the US results, I conclude that both cultural and material factors contributed to Google Chrome's popularity on desktop computers. Providing support for theories drawn from the sociology of consumption (Bourdieu 1984; Lamont 1992; Peterson and Simkus 1992; Veblen 1899; Wherry 2012), Chrome users are different from non-Chrome users in terms of demographics and attitudes about the internet and the companies that provide service online.

More importantly, Chrome's popularity is also due to the fact that it is a broker that is captured by content producers on the internet. As the browser is affiliated and fully owned by some of the most popular content online (i.e., Google), most Chrome users prefer the browser because they believe it's the most efficient broker to rely upon to access this content. The fact that Google Chrome's structural position contributed to its popularity in the US web browser market provides support for Stovel et al. (2011).

CN discussion

In contrast to the US findings, I found that Google Chrome's popularity in the Chinese desktop browser market was only due to cultural factors (please see Chapter 4 for more details). From my survey results, I found that internet users were more inclined to use Google Chrome if they were younger. Also, those who trusted American tech companies and distrusted Chinese tech companies to handle their personal information were also more inclined to use Google Chrome. The strongest predictor for Chrome use in China was whether the internet user was college educated or not. Internet users who had a college degree were more inclined to use Google Chrome on their desktops.

The interview results provide a possible explanation as to why internet users with a college education were more inclined to use Google Chrome on their desktops. All of the Chrome users that I interviewed at East China Normal University only started using the Chrome browser when they came to college. Many of them had difficulty accessing the school websites that they needed to use to register for their classes and/or conduct literature reviews for their school projects. When encountering these challenges, their friends and more senior classmates often suggested that they install Google Chrome as a more reliable way to access these resources.

In fact, ECNU officially recommended students to download Google Chrome (and Mozilla Firefox) if they are encountering any difficulty accessing their websites.

Form my interviews, I also found a possible reason as to why internet users who trusted American tech companies and distrusted Chinese tech companies were more inclined to use Google Chrome. When asked to justify why they prefer Google Chrome over the other web browsers that are available to them, most Chrome users cited the browser's minimalistic and clean design, which made the browser more comfortable to use. This sentiment was usually juxtaposed with how they felt about some of Google's Chinese competitors in the web browser market, like 360 Browser and UC Browser. Many of the Chrome users I interviewed had pretty negative perceptions about Chinese browsers. Not only did they believe that these browsers were littered with advertisements, pop-ups, and portal links that were distracting to their online experiences, but they often found the way these Chinese companies marketed their software, including their browsers, distasteful.

The Chinese results also provide some insights as to why internet users may shy away from using Google Chrome on their desktops. As Google Chrome is a software program that does not usually come "out of the box" with the computers that Chinese internet users buy, most internet users who did not use Google Chrome were internet users who were perfectly happy with the web browser that came pre-installed on their computers, and they were content with the way their web browser presents information to them. Not only did these users have no complaints about the way Chinese tech companies marketed their software programs, but they also were more inclined to find it important that their web browser is pre-installed on their computers.

All in all, the survey and interview results show that only cultural factors contributed to Google Chrome's popularity in the Chinese desktop browser market. Once again, providing support for theories drawn from the sociology of consumption (Bourdieu 1984; Lamont 1992; Peterson and Simkus 1992; Veblen 1899; Wherry 2012), Chrome users are different from non-Chrome users in the country, in terms of demographics (i.e., age and education) and attitudes regarding the tech companies that facilitate their online behaviors. Unlike in the US, there is no evidence indicating that Google Chrome's structural position helped make it the most popular desktop web browser in the country.

Difference in internet economies, difference in preferences and logic

Although Google Chrome is the most popular web browser on internet users' desktops in the US and China, the reasons as to why the browser is popular is different in the two countries. In the US, both cultural and material factors play a role in Chrome's popularity, whereas only cultural factors matter in the Chinese context. The reason why there is this difference has to do with the makeup of the larger internet economies in the two countries. In the US, one of the most important drivers to Chrome usage on the desktop is a desire for a browser that is well-integrated with their favorite web services, like search, email, and productivity apps, which are often owned and operated by Google. As almost all of these Google web services are banned in China since 2010, it just is not "legally" possible for Chinese users to prefer the browser because they think the browser is the best way to access their favorite web services. Without using a Virtual Private Network (VPN), most Chinese internet users cannot engage with Google's search engine, email client, YouTube, along with other platforms and content made by American tech companies. Because of this barrier of access, it is quite possible that Chinese users never developed a

preference for Google's web service, and so this kind of integration between browser and content that American users enjoy does not matter in this context. In other words, the structural advantage that Google has of having their browser vertically integrated with their popular web services is not exactly existent in China (at least legally speaking).

In sum, although Google Chrome is the most popular web browser on the desktops of American and Chinese internet users, the reasons as to why users from these two countries choose Chrome are significantly different, largely due to the material and cultural environments of the two countries. As Google is able to occupy a material and cultural position in the American market, in which it is known to be the "anti-Microsoft" with concrete connections to the web services that Americans popularly utilize, it is able to attract users who not only respect the company's cultural reputation, but also those who want the most efficient way to access Google's suite of web services and resources. As Google's most popular web services have been banned in China since 2010, Google was only able to utilize its position in the cultural environment to attract users for its Chrome browser in China. Although Google Chrome is the most popular desktop browser in the US and China, the reasons as to why the browser is popularly preferred is different due to the larger structural differences between the American and Chinese internet economies. By comparing how internet users in the US and China choose their web browsers, I highlight how utilizing a structural framework that was outlined in Emigh et al. (2016a, 2016b) and Sewell (1992) can be fruitful in observing the cultural and material factors both in the micro and macro levels that drive how people behave.

Study limitations

There are several limitations to this study. For one, the survey samples are not exactly generalizable to the larger internet-using populations in the US and China. As the US sample was recruited through an online crowdsourcing marketplace (i.e., Amazon MTurk) and the Chinese sample was recruited through an online panel service (i.e., Cint), it could be argued that those who participate in these services may be objectively different, especially in terms of demographics, from the larger internet using population. Future studies may want to take this into consideration and try to collect an actual random sample in the two countries for a more accurate description of how people in the two countries use the web.

Additionally, the interview results are also not generalizable to the larger internet using population in the two countries. As the interview respondents from both countries consist of only undergraduate students, the results only reflect the thinking and preferences of a subset of the larger internet using population in the two countries. As the interviews were designed to qualitatively discover how and why people use their web browsers, future studies may want to collect interview data with a more generalizable sample to better capture the process and thinking of internet users in the two countries.

Also, as it is understood that many Chinese internet users use VPNs to access online information and resources that have been banned in the country, the one-time 30-45 minute interviews that I conducted at East China Normal University may not have been the best way of accurately capturing how my participants accessed the web. As VPN use is "technically illegal," it is likely that my respondents were hesitant to admit to using a VPN because they didn't trust me. To accurately capture how Chinese internet users go online, a series of longitudinal

interviews with each participant may be better to gain their trust and rapport so they'd be more comfortable accurately sharing how they go online without any social desirability bias.

Lastly, future studies that wish to understand why Google Chrome became the most popular web browser in China need to also trace the historical trajectory of the Chinese web browser market. Although I was able to capture through interviews and surveys how people started using Google Chrome and why they think they use the browser, it does not exactly capture the "supply-side" story. It might be insightful to capture how Google marketed their browser in China, and whether there was something that Google did in the country that made its browser more appealing to use in China. For example, as this study shows that one of the biggest predictors of Chrome usage is whether the user has a college education, there is a possibility that Google may have specifically marketed the browser to colleges and universities in that country. It would be important to capture this with historical data.

Research implications

This study provides some design and marketing implications for firms that are responsible for making web browsers and other information brokers that facilitate information sharing between consumers and producers. This section is organized in the following manner: First, I provide recommendations for web browser makers in the US and China. Then, I discuss how information brokers could generally use these findings.

Implications for American web browser makers

In the US, as the biggest driver to Chrome usage is a user's preference for a browser that is well-integrated with their favorite web services, I would argue that if Google wants to continue to

retain these users, it might be a good idea to incorporate a web browser design that maintains the minimalistic look of the browser while also emphasizing its integration with Google's popular web services. One of the more promising prototype designs that I've seen on the web that play into Google users' inclination is a design where there is only a search bar and a button that lists out the various popular Google Apps (e.g., Google Drive and Gmail) that people use.[6] In other words, Google Chrome could take on a form where the only explicit and readily available features (outside of the window for correctly displaying websites) are ones that provide an efficient means of accessing the popular services that people use when they go online, which are often owned by Google.[7]

As it is undeniable that Google's marketing campaign around the Chrome browser also helped establish a cultural environment that attracted internet users, this dissertation's findings also suggest that Google should continue to market its browser as the best way to access all of Google's popular web services. Google should continue to make television and internet ads that highlight how the Chrome browser is vertical integrated with Google's ecosystem of apps, and that the browser is really the best window to access these resources. Google should also continue

[6] For a more detailed look on the prototype, see: https://medium.muz.li/how-i-redesigned-google-search-59ddb28b7c87

[7] More "traditional UX research" could be done to see whether this kind of design direction is profitable for Google. If it is determined that it is valuable to find ways to improve the product for existing users, one could simply do an A/B test with a simple random sample of current Chrome users, in which the "A" group would be the control group, where they will continue to use Chrome with the existing layout, and the "B" group will be given the new layout. After about two days of usage, a survey could be fielded to both groups, and if the satisfaction score is higher for those who have been using the new design, then it is further proof that web-integration is something that existing Chrome-users want.

to do what they are doing on Chrome's download page, in which they try to sell the browser by highlighting how it is the only browser that has "Google's smarts built-in."[8]

On the other hand, as some of the biggest deterrents of Chrome usage in the US are the user's preferences for a browser that blocks ads and respects their privacy, these findings suggest that web browser makers, other than Google, can carve out their own niches in this market by incorporating design elements and marketing campaigns that emphasize the security and privacy protections that are built-in to their browsers. Not only could this be represented in the design language, like building a button (like the ones made by DuckDuckGo) in the browser to highlight how many trackers and ads have been blocked whenever a user visits a website, but these companies could also use marketing campaigns to convince potential users that their browsers value their privacy, just like how Mozilla and Microsoft are already doing with their browsers' download pages. For example, on the download page for Mozilla Firefox, Mozilla is selling the browser by touting its privacy features, "Automatic privacy is here. Download Firefox to block over 2000 trackers."[9] Similarly, Microsoft also emphasizes its privacy functions on the download page for its new Microsoft Edge browser.[10]

As the US results offer suggestions on how Google and its competitors can continue to retain their existing users, the results also provide some direction for how these web browsers, specifically Google Chrome, could increase their market share, even though these actions may not be 100% feasible. If Google wanted to attract users from Mozilla Firefox and Microsoft Edge, the easiest way for them to do it would be to make explicit guarantees that the browser

[8] Google Chrome's webpage: https://www.google.com/chrome/

[9] Mozilla Firefox's webpage: https://www.mozilla.org/en-US/firefox/new/

[10] Microsoft Edge's webpage: https://www.microsoft.com/en-us/edge

would respect its users' privacy. For example, it has been documented that Chrome ushered significantly more tracker cookies into their browser, especially compared to browsers, like Firefox (Fowler 2019). One of the easiest ways for Chrome to show that it cares about privacy is to limit the number of tracker cookies that are used to build profiles on their users' interests, income, and personality for advertising purposes. However, as most of Google's revenue stems from its advertising business that relies on these cookies, the decision to improve the browser's privacy might not be the most profitable action.

On the other hand, the results also suggest a way for Google to cannibalize Apple Safari's market share. As most Safari users are drawn to the browser because it is the most readily available browser on their Apple computers, a way for Google to get these users to start using Chrome is if Google could make a deal with Apple to allow them to pre-install Chrome on Apple's laptops and computers. However, as Apple is extremely proud and protective of their closed ecosystem of apps, a deal like this is quite impossible, and it may not be worth it, considering how small Apple Safari's market share is.

Lastly, these findings also suggest that Apple, Microsoft, and Mozilla could gain more users from Google if they could somehow make their browsers more integrated with Google's ecosystem of web services. Not only would revamping their browser so it's built using Google's Chromium (the free and open-source source code that Google used to build Chrome) help, especially since it increases its compatibility with all the web services and resources that are currently compatible to Chrome, but it would also help if they included buttons or tabs on their browsers that quickly and easily connect to Google's suite of web services, especially if they come "out of the box" with the native browser (and not as a plug-in or an extension). Although some companies, like Microsoft, have invested in increasing their browser's general

compatibility by rebuilding their browsers using Chromium (Warren 2020), it would be harder for these companies to include any explicit features that readily and easily connects their users to Google's ecosystem, especially since many of Google's web services compete with the other offerings from these web browser makers (e.g., Apple, Microsoft). Furthermore, as some web browser makers, like Mozilla, have actively cultivated a niche market by explicitly forgoing Google's tracking (Fowler 2019), it may not make sense for the web browser makers to turn their backs on their existing customers by increasing the browser's integration with Google's web services.

Implications for Chinese web browser makers

In China, desktop Chrome usage is significantly associated with an internet user's college education and trust in western tech companies, in which many users prefer Google Chrome because it's not made by a Chinese tech company that is known to bombard their users with undesired information. For web browser makers interested in usurping Chrome's market share in China, these results suggest that one of the ways they could increase market share is to ensure that their web browsers can properly access all the websites and resources that college students frequent. One possible way to ensure that their browsers will work with all college websites is to rebuild their browsers using Chromium's source code. To really ensure that there is no ambiguity whether the browser will work for each university's web resources, it also might be worth investing in an outreach program with all the major universities in the country to not only work with each school's web development teams to make sure the sites are optimized for their browser, but to also become the web browser that the school recommends to their students for efficient and effective access to their sites.

As many Chrome users are turned off by the abundance of unnecessary information and pop-ups that are built into Chinese browsers, it might be helpful to make all the non-core features of the web browser optional to its users. For example, instead of assuming that their users all want to see pop-up ads and portal links whenever they open their browser, I believe the browser would be more attractive to users if they give users the option to opt-in to these ads and portal links when they first open the browser. This can come in the concrete form of giving users the option to opt-in to specific ads, portal links, or news during the set-up phrase when they open the browser for the very first time. To make opting-in to these pop-ups attractive, it might be smart to also provide some kind of incentive to users for opting-in.

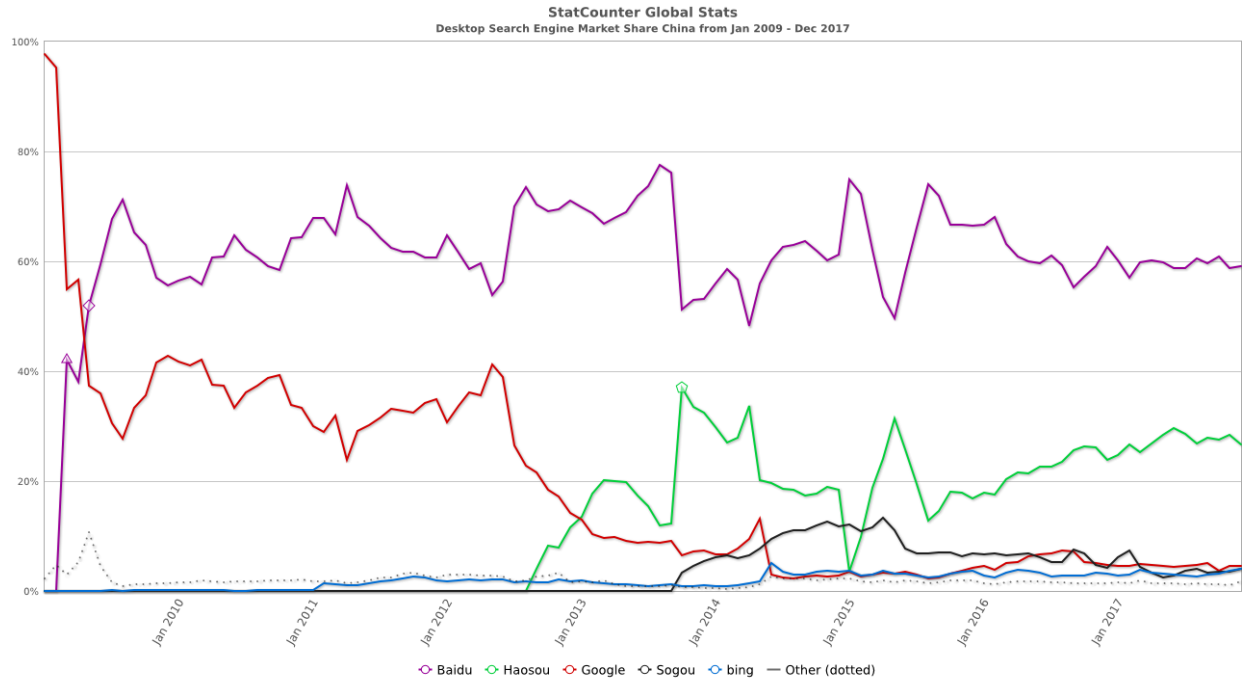
On the other hand, the Chinese results also provide some actionable insights for Google, especially if they are interested in increasing their already dominant market share. As one of the most important factors that drive people away from using Google Chrome on their desktops is if the user finds it important that their web browsers are pre-installed on their desktop computers, I believe Google could increase its web browser market share by spending more money convincing computer vendors to pre-install their browsers on the computers that they sell. Since the people who are less likely to use Google Chrome on their desktops tend to be internet users that never problematized their web browser preferences, and they often just use whatever that comes installed on their computers, I believe the simplest way to convince them to use Chrome on their desktops is to make Google Chrome the only and most readily available option to users whenever they buy a new computer. However, more research on the computer seller market and the revenue generated from each new Chrome user would need to be collected to know if this is something that is worth pursuing.

By comparing the American and Chinese results of this dissertation, one might also ask if it is possible for a Chinese web browser to establish a similar kind of structural advantage that Google enjoys in the US in China's internet economy since many American companies that provide web services for most of the world are banned in China. From my understanding of China's internet economy and through my findings, I don't think it is possible.

I suspect there are several reasons for this: For one, it may not be possible for a single browser in China to be well-integrated with the most popular web services in the country. Unlike the US internet economy, the "essential online services" that people frequent in China are disparately owned and operated by different Chinese tech giants. Unlike in the American internet economy, one company is not responsible for the most popular search engine (i.e., Baidu), the most popular email client (i.e., Tencent's QQ or NetEase's 126.com and 163,com), and the most popular video streaming platform (e.g., Baidu's iQiyi, Tencent's QQ video, and others). The fact that no Chinese tech company has a clear market advantage in all of these spaces makes it hard for any browser to actively market the perception that their browser is the most efficient way to access all the services that internet users popularly use.

People also may not be interested in using any Chinese-made browser because they still fondly remember using Google Search and YouTube, and they still know and respect Google's international presence. Before Google's services were completely banned in China, the most popular search engine in the country was actually Google Search (see Figure 18). Not only did a majority of internet users in China use Google services before they were completely banned, but even to this day, most internet users know what Google is, know about their international presence, and frequently use products that are actually built on Google's open-source technologies. For example, almost all of the Chinese-made smart phones have operating systems

that are built off of Google's Android open source project. Furthermore, many of the Chinese browsers that Google competes against, like the 360 Browser and QQ Browser, are built using Google's Chromium as their bases. So even though Google's popular web services (e.g., search, gmail, YouTube) may not be legally available to Chinese internet users, most internet users, especially those who pay attention to consumer technology developments, should be well aware of Google's international reach, and may be drawn to the browser because they respect Google's cultural reputation.



[Figure 18. Desktop Search Engine Market Share in China from Jan 2009 – Dec 2017]

Furthermore, there is a possibility that most Chinese internet users are already frequent users of Google's "banned-on-paper" web services. Although many web services and platforms that American internet users take for granted (e.g., Google Search, YouTube, Facebook, Twitter)

are banned in China, it is known that many Chinese internet users still access and engage with these products by leaping over the "Great Firewall" using various VPN tools. As VPN use is technically illegal in China, I was not exactly able to capture how VPN usage could affect the web browser choices of my interview and survey samples.[11] There is a possibility that internet users popularly prefer Google Chrome on the desktop because they are actually active users of the many Google web apps that American users enjoy with the assistance of a VPN client. So, it may not matter whether there is a web browser that is well-integrated with popular Chinese web services because these users prefer to use a VPN to access banned web services.

Implications for Information Brokers

Since web browsers can be treated as information brokers that facilitate the information flow between consumers and producers, the findings from this dissertation also provide some insights as to how one could create a popular information broker no matter the industry or the space. In both the US and China, internet users popularly prefer a broker that could efficiently and effectively help them access the information that they desire. In the US, this comes in the form of being well-integrated with popularly used web services. In China, this comes in the form of presenting information and resources in an effective and non-intrusive (i.e., no ads, no pop-ups) manner. Although how a broker can be efficient and effective is contingent on the larger

[11] I did use a list experiment (or item-count technique) to approximate the proportion of survey respondents that have used VPN before. However, since my survey sample is not nationally representative, and it was not exactly recruited using a truly random sample, I could not confidently draw too many conclusions from the experiment. For more details and results of the list experiment please see: https://www.kevinjshih.com/ux-projects/project-three-8b7mm

structural environment that the broker is situated in, the idea is that any broker has the agency to alter the cultural and/or material environment to its advantage.

From the case of web browsers, it seems that the most appealing cultural reputation a broker can adopt is one of efficiency and effectiveness. In the US, Google Chrome's popularity corresponds to the cultural environment that Google has established for itself—a company that is part of the free and open source software movement that is primarily concerned with making the web an efficient and cool computing platform (for most people, it doesn't matter that Google, like Microsoft in the late 90s and early 00s, has a vertically integrated ecosystem that most people use). Google Chrome's cultural reputation in China is also associated with its ability to efficiently and effectively help users access the information they want, especially when compared to the other Chinese-grown browsers that are available in the Chinese market. Unlike most Chinese web browsers, Google Chrome is not littered with pop-up ads, notifications, and portal links so it provides its users with an efficient means to navigate the web with very little distractions. No matter whether you are a broker technology in the US or China, the results suggest that your popularity may be contingent on whether you can convince your potential users that you can efficiently broker information for them in a distraction-less manner.

A broker's popularity is also contingent on its position in the material environment. One of the most important reason as to why most American internet users use Google Chrome is because of the fact that it is well-integrated with their favorite web services, which are often owned and operated by Google. Although this finding is not observed in the Chinese web browser market because the Chinese market is structurally different from the American market, in which it might be impossible for a web browser to achieve this material position in China, one can see the importance of this with other information brokers in the country. For example,

WeChat is popular in China because it is vertically integrated with many services and resources that are popularly utilized by Chinese users. In general, if a broker can acquire a position, in which it is captured (i.e., vertically integrated) with content that people popularly use, users are going to be more inclined to use the broker. Thus, one of the ways a broker can guarantee its popularity is by ensuring that it occupies a position that makes it the most efficient means of accessing content producers that people popularly prefer.

All in all, this study highlights how one could study the popularity of an information broker by framing information broker choice as a social action that is embedded in a social structure that consists of mutually sustaining cultural schemas and material resources. By specifically examining how people choose their desktop web browsers in the US and China, I show that browser preferences are affected by cultural and material factors that can be more easily identified when you frame the decision as a social action performed in a social structure. Future studies that wish to examine other kinds of technologies that facilitate the information flow between consumers and producers (e.g., smart phones, search engines) could utilize this framework to better understand their popularity.

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